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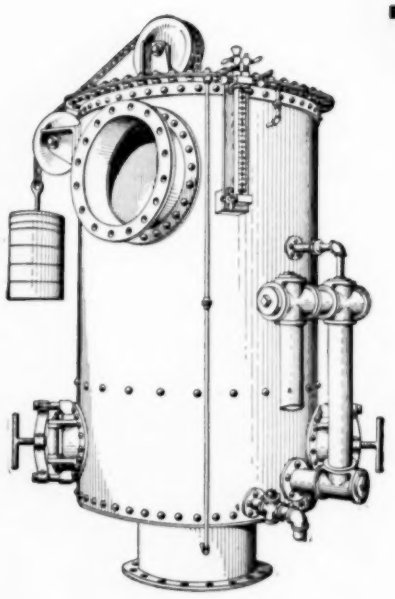

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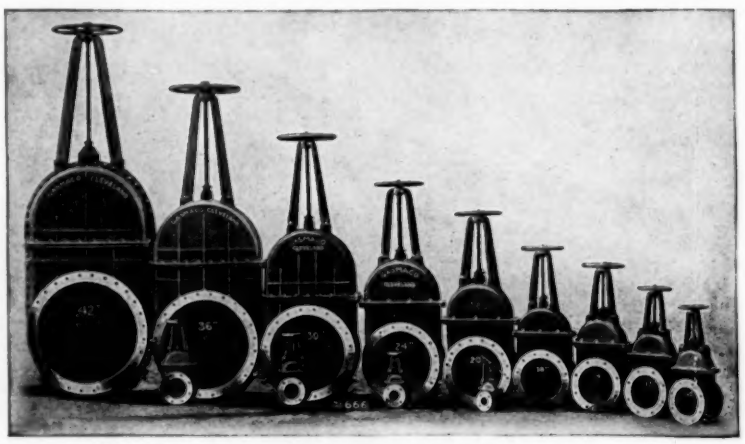

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THE AMERICAN GAS LIGHT JOURNAL INC.

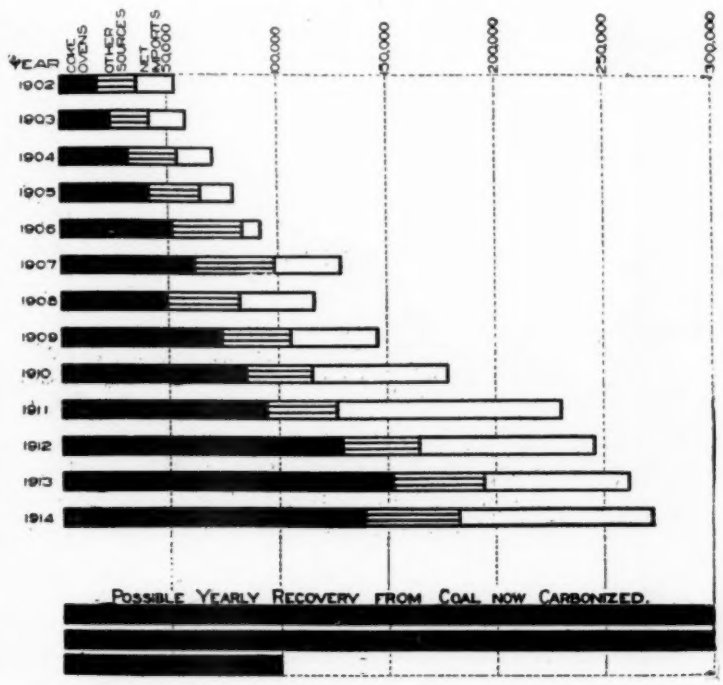
VOL. CIII., No. 11. NEW YORK, SEPTEMBER 13, 1913. WHOLE No. 2,101

THE PRODUCTION OF SULPHATE OF AMMONIA IN 1914.

[From a Circular of the American Coal Products Company.]

For the first time in years, it is impossible to discuss the world's production of sulphate of ammonia from a basis of actual figures. The principal European producers, Germany, England, France, Belgium, Austria and Italy are engaged in warfare, and under these circumstances European statistics are obtainable only to a limited extent. We are, however, able to report definite decreases in the year's output of England and the United States, due to the conditions existing in the last half of 1914. In Germany, it seems almost certain that a probable increase in the first half of the year was more than counterbalanced by a heavier decrease in the last half. The production in Belgium was practically eliminated for the last half of the year, and presumably suffered in France for the same period. On such data as this, our estimate of the world's output is a guess, but it may be hazarded at about 1,300,000 to 1,350,000 metric tons, as against 1,409,000 in 1913.

As regards the prospects for 1915, it is quite probable that, contrary to expectations, there will be an increase rather than a further decrease. Modern explosives require the production of benzol, toluol and ammonia, and these demands have brought the corresponding branches of by-product recovery into strong favor. For this reason existing plants will be operated at full capacity where ever possible, and the replacement of bee-hive by recovery coke ovens has been to some degree encouraged. The demand for war munitions has reacted on the steel industry, both directly and indirectly, and there has been an increase in production, which brings with it an increase in coke and ammonia. This is true of the United States and of England, and in Germany it is reinforced by the need of benzol as a motor fuel, and of sulphate of ammonia as a fertilizer, the latter to replace the nitrate of soda hitherto imported. With the prospect that business will be good until the close of the war, and possibly longer, it seems not unreasonable to expect that the ammonia production will increase correspondingly.



United States Production, Net Imports and Consumption of Sulphate of Ammonia and Sulphate Equivalent, together with estimate of the amount recoverable annually from the coal now made into coke. Net ton = 2,000 pounds.

Sources of Production.—The by-product coke oven continues to be the main source of ammonia recovery, and the one that promises the most extension in the immediate future, coal gas works standing next in total output, though much greater in number and more widely distributed geographically. The by-product recovery gas producer, the shale oil distillation process, and the English blast furnaces using splint coal, are also responsible for a certain amount annually. Some is also obtained from the carbonization of bones, and from peat, there being two Italian plants reported as operating on this material. The methods by which atmospheric nitrogen is transformed into ammonia, viz., the synthetic process of Haber and La Rossignol, and the manufacture of calcium cyanamid, afterwards treated to liberate ammonia, appear to have been extensively pursued in Germany, because of the needs of war and of agriculture. So far the Haber process has not been introduced elsewhere, but the production of ammonia from cyanamid has been carried on in Germany and Italy, and to a limited extent elsewhere. It is interesting and significant to note in this connection that a bill has recently been introduced in the German Federal Council to create a nitrogen monopoly in Germany extending to 1922.

Commercially, the season of 1914–15 was one of hope deferred rather than of fulfilment. The unfavorable prospects at the close of 1913 were adequately realized in a market that sagged continually throughout the first half of 1914. The outbreak of war, coming in the quiet season, did not change matters very much either way. The embargo placed on sulphate of ammonia exports by the German government in September, which might have operated favorably on English prices, was neutralized in effect by the unfavorable cotton situation in the United States, and the increased risk and cost of ocean transport. Toward the close of 1914 more favorable conditions began to prevail and prices began to have an upward tendency. The monthly English quotations, however, have averaged from 25 to 50 shillings below those of the previous year, and the average for the year is 40 shillings lower.

Production of the United Kingdom.—The production of sulphate of ammonia and its equivalent in the United Kingdom is given in Table II., as reported by the British Alkali Committee. It ammounted to 426,412 gross tons, there being therefore a shortage of 6,200 tons as compared with the output in 1913. The cause of this reduction is, of course, the war. Examination of the separate items shows that the gas works have lost most heavily, the iron works quite considerably, and the shale works a small amount. Part of these

losses was neutralized by a substantial gain in the by-product coke ovens, and a slight one in the producer and carbonizing works.

The consumption of ammonia in all forms, reckoned as sulphate, is estimated at 106,000 tons in 1914. an increase of 9,000 tons over 1913.

The average price of the 24% grade at Hull for the year 1914 was £11 7s. 1d. as compared with £13 7s. 8d. for the year 1913, a drop of 40s. 7d.

The English exports in 1914 were 313,877 tons, nearly 12,000 tons less than 1913, which under the circumstances is not surprising. Japan is still the largest single customer, though taking 30% less than in 1913. The quantities are as follows: Japan, 87,776 tons; Spain and Portugal, 59,863 tons; Java, 54,869 tons; United States, 43,651 tons; Holland, 9,074 tons; British Guiana, 8,578 tons; the Canaries, 7,932 tons; the West Indies, 7,299 tons: Mauritius, 6,690 tons; Italy, 5,060 tons; Germany, 3,427 tons; France, 2,486 tons; Belgium, 1,032 tons; the balance, 16,140 tons, being distributed among other countries.

Production in Germany.—There are no figures at hand to indicate whether the German output of 548,560 tons in 1913 was exceeded in 1914 or not. So far as can be judged by trade conditions, there was an increase in the production during the first half of the year, although the demand for coke was not active. The following is taken from the annual report of the Deutche Ammoniak-Verkaufs-Vereinigung;

"The beginning of 1914 did not reveal favorable conditions for the disposal of sulphate of ammonia. In spite of the reduction in our price made toward the end of 1913, a large quantity still remained unsold at the end of the shipping season, i. e., the spring of 1914. The production of sulphate of ammonia at the coke works has increased by leaps and bounds in the last few years, and now that the new synthetic process has been reduced to practice, it should receive further addition.

"In the foreign market English competition made itself strongly felt. In addition to this, other nitrogen carriers, as Chilean and Norwegian nitrate and cyanamid, were freely offered. Although early in 1914, Japan and especially America unexpectedly made their appearance as buyers of respectable amounts for spring delivery, the market was not steadied. The supply was in excess of the demand. Under these influences the English quotation fell continuously from M 24.35 per 100 kilos at the beginning of January to M 20.35 at the end of May. During this time our exports amounted to 67,000 tons, as against about 38,000 tons for the same period of 1913.

"As the year progressed foreign takings still failed to improve, in spite of the lowered prices, and England prepared to contest the home market with us by liberal price concessions.

"This effort was practically checked by our existing agreements with the largest of the German consumers, but it disturbed the German market and, together with a fall in the price of Chilean nitrate, make it seem advisable for us and our associates to lower our prices for the fall trade.

"The outbreak of war at the beginning of August did not notably affect the market. Uncertainty prevailed, and it seemed probable that the lack of skilled labor would prevent the saving of the partially gathered harvest as well as hinder adequate and timely planting in the spring. Doubt as to the progress of the war paralyzed action. In Germany this feeling soon gave place to confidence, and careful examination of the new conditions brought the conclusion that with the restriction in the imports of Chilean and Norwegian nitrates there would soon be a scarcity of nitrogen in Germany.

"The inquiry for sulphate of ammonia became active and offerings were not adequate. The middleman's prices rose to such an extent that the government intervened, and with the co-operation of those concerned, established maximum prices.

"In consideration of the fact that the war made a reduction of price necessary, and further that the manufacturing costs had been increased, we were able to make arrangements with many of our customers to cancel the price reduction agreed upon. For this reason the reduction was but little felt by us after all.

"At the end of September the government of Germany prohibited the exportation of nitrogen. In consequence of this we were compelled to cancel the sales we had made in foreign countries, including the United States. This we were able to do without difficulty. Previous to this circumstance our export business in 1914 had been steadidly increasing. Contracts for a total of 155,500 tons had been definitely closed, including nearly all the agricultural countries of the world, as against 66,000 tons for the year 1913, this being an increase of 89,500 tons for export. The demand was particularly active in the United States, a territory that we may profitably devote particular attention to later on should the demand in Germany prove unable to absorb the home production. War has changed many preconceived notions in this direction, as in others, and many German consumers, who have used other forms of nitrogenous fertilizers hitherto, will have been convinced by the enforced trial, of the advantages of support of ammonia as a fertilizer.

Owing to the state of war the comparison of the amounts sold at home in 1913 and 1914 does not indicate much, but nevertheless, the figures may be of interest. The sales of our organization for home use was as follows:

	1914.	1913.
Period January-July.....	191,062 tons	173,856 tons
Period August-December.....	130,342 tons	78,067 tons
	321,404 tons	251,923 tons

The total tonnage disposed of for the year by the Vereinigung was 413,837, as against 335,235 tons in 1913. Of the 1914 quota 406,476 tons was produced by members of the Vereinigung, the balance by others, among whom the Badische Aniline and Soda Fabrik appears for the first time, with 1,450 tons produced by the Haber process. This amount is probably not the total output of the above works.

On December 14, 1914, the official maximum price for sulphate, as referred to above, was fixed at M 27.00 per 100 kilos ($58.31 per net ton) for 25% grade, and M 27.50 for the dried and ground, annalyzing 25.5% NH_3, in quantities of five tons or over, including freights to districts adjoining and west of the Elbe, excluding cost of sacks; smaller quantities M 1.50 per 100 kilos more, excluding freight and sacks. On June 1, 1915, these prices were advanced to M 30.50 for the 25% and M 31.00 for the 25.5%.

The proposed German nitrogen monopoly, to which reference has been made, is to extend for seven years, that is to say, until March 31, 1922. It applies to the following products: Inorganic nitrogenous material (nitrates of potash and soda); primary artificial nitrogen products (nitric and nitrous acids and ammonium cyanamide); and all nitrogenous fertilizers prepared from these products, or in other ways. The object, as stated, is to render German agriculture and manufacture independent of foreign sources of production, and to make the nitrogen recovery plants erected during the war, profitable after it is over.

According to the official returns, Germany exported 75,868 metric tons of sulphate of ammonia in 1914, and imported 34,628 metric tons.

The United States.—The production of the United States in 1914 was only 183,000 net tons of sulphate and its equivalent, less by 12,000 tons than in the year before. This reduction came mostly in the last half of the year and was due to the influence of the European war on the iron and steel trade. Had business kept the pace of the first 6 months there would have probably been a small increase over 1913, in place of a deficit. Of the 183,000 tons produced, 139,500, or 76%, are chargeable to by-product coke ovens, and the balance, 43,500 tons, to the coal gas works, bone carbonization, and other sources.

The addition to the by-product coke ovens for the year 1914, included 41 Semet-Solvay ovens at Indianapolis, 27 Gas Machinery Company's ovens at Johnstown, Pa., 120 Koppers ovens at Sparrows Point, Md., and 18 Wilputte ovens at Joliet, Ills. Besides these, 224 Koppers ovens at the Bethlehem Steel Works, and 56 for the Laclede Gas Company at St. Louis went into operation, the former early in 1915. Construction of the 100 Otto ovens at Buffalo is held up by the war. An addition of 20 ovens to the Inland Steel Company's plant at Indiana Harbor, Ind., went in during January, 1915.

New plants expected to come into operation during 1915 include the Chattanooga Gas & Coal Products Company, 12 Roberts ovens at Chattanooga, in July; the Youngstown Sheet & Tube Company, 204 Koppers ovens at Youngstown, O., at about the end of the year, and the Minnesota Steel Company at Duluth, 90 Koppers ovens, already completed. Additions comprise 92 Koppers ovens to the Republican Iron & Steel Company's plant at Youngtown, O., and a reconstruction of the 120 ovens at Glassport, Pa., for the Allegheny By-product Coke Company.

The figures for the United States ammonia production showing amount and proportion derived from coke ovens from 1901 to 1914 inclusive, are given in Table IV.

The imports, exports, amount available for consumption and average price are given in Table V., the import figures including those for muriate (chloride) of ammonia since 1912, when the separate figures were published by the Department of Commerce.

TABLE I.—*World's Sulphate of Ammonia Production:* (*In metric tons of 2,204.6 pouuds.*)

Country	1906	1907	1908	1909	1910	1911	1912	1913	1914
England	294,170	318,400	330,450	354,747	373,590	391,160	394,540	439,565	433,259
Germany	235,000	287,000	313,000	330,000	373,000	418,000	492,000	548,558	
United States	68,000	90,120	79,500	96,600	105,143	115,245	149,700	176,900	166,016
† France	49,100	52,700	52,600	53,600	56,000	60,000	68,500	74,500	
† Belgium and Holland	30,000	*55,000	§35,000	§40,000	§43,000	§43,000	§55,800	§53,600	
† Spain	10,000	‡12,000		12,000	9,000		§9,000	§15,000	
† Italy	5,000	11,000	§80,000	12,000	12,000	§166,500	§15,500	§15,000	
† Other Countries	40,000	65,000		§73,000	§79,000		¶68,800	¶86,100	
Total	731,270	891,200	890,550	971,947	1,050,733	1,193,905	1,253,840	1,409,223	

* Including Norway, Sweden and Denmark. † Estimates from l'Engrais. ‡ Including Portugal.
§ Estimates from Deutsche Ammoniak-Verkaufs-Vereinigung, 1908-9-10-11-12-13. ¶ Estimated.

TABLE II.—*Ammonia Sulphate and Equivalent Produced in the United Kingdom.* (*Tons of 2,240 pounds.*)

Year	1906	1907	1908	1909	1910	1911	1912	1913	1914
Gas Works	157,160	165,474	165,218	164,276	167,820	168,733	172,094	182,180	175,930
Iron Works	21,284	21,024	18,131	20,228	20,139	20,121	17,026	19,956	16,008
Shale Works	48,534	51,338	53,628	57,048	59,113	60,765	62,207	63,061	62,749
Coke Ovens	43,677	53,572	64,227	82,886	92,665	105,343	104,932	133,816	137,430
Producer Gas & Carb'g Works	18,736	21,873	24,024	24,705	27,850	29,964	32,049	33,605	34,295
Total	289,391	313,281	325,228	349,143	367,587	384,926	388,308	432,618	426,412

These figures are from the Alkali Inspector's reports.

TABLE III.—*Production of Ammonium Sulphate and Sulphate Equivalent from By-product Coke Ovens and Gas Works in Germany.*† (*In metric tons of 2,204.6 pounds.*)

	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Coke Ovens	152,000	168,000	.....	257,000	.....	270,000	313,000	351,000	.....	475,558
Gas Works	21,000	22,000	.....	*30,000	.....	60,000	60,000	67,000	.....	73,000
Total	173,000	190,000	*235,000	*287,000	*313,000	*330,000	*373.000	*418,000	*492,000	*548,558

* Deutsche Ammoniak-Verkaufs-Vereinigung, 1906-07-08-09-10-11-12-13.
† Dr. N. Caro, Zeit. f. angew. Chem., Sept. 14, 1906.

TABLE IV.—*United States Ammonia Production, Expressed in Sulphate Equivalent.* (*In tons of 2,000.*)

	1901	1902	1903	1904	1905	1906	1907
By-product coke ovens	15,279	18,483	24,098	32,653	41,864	.....	62,700
Coal gas and bone carbonizing works	*14,000	*17,641	*17,775	*22,011	23,432	.....	36,609
Total	29,279	36,124	41,873	54,664	65,296	*75,000	99,306
Per cent from coke ovens	52%	51%	57%	60%	64%	.....	62%
	1908	1909	1910	1911	1912	1913	1914
By-product coke ovens	50,073	75,000	86,000	95,000	130,000	153,000	139,500
Coal gas and bone carbonizing works	33,327	*31,500	*30,000	*32,000	35,000	*42,000	*43,500
Total	83,400	106,500	116,500	127,000	165,000	195,000	183,000
Per cent. from coke oven	60%	70%	74%	75%	79%	78.5%	76%

* Estimated.

TABLE V.—*United States Ammonia Consumption, Expressed in Sulphate Equivalent.** (*In tons of 2,000 pounds.*)

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914
Imports—Sulphate of Ammonia	16,777	16,667	15,288	9,182	30,614	34,274	40,192	62,611	103,743	73,814	60,579	83,377
Muriate of Ammonia	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,842	5,204	4,588
Exports—Sulphate of Ammonia	.....	.....	.....	.....	.....	.....	.....	345	316	67	112	.....
Muriate of Ammonia	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	.....	.....
Net imports, Sulphate Equivalent	16,777	16,667	15,288	9,182	30,614	34,274	40,192	62,266	103,427	81,089	67,024	89,158
Available for consumption	58,650	71,331	80,584	84,182	129,923	117,674	146,692	178,266	230,427	246,089	262,024	272,158
Average price	$62.10	$61.71	$62.92	$62.33	$61.93	$59.90	$56.04	$55.60	$62.21	$65.57	$62.86	$54.20

* The figures for consumption and price are for the calendar year, while those for imports are for the fiscal year ending June 30th of the year specified. Beginning with 1912 the imports of muriate of ammonia were reported separately by the Department of Commerce.

TABLE VI.—*Ammonium Sulphate and Sulphate Equivalent Produced in France.* (*Tons of 2,204.6 pounds.*)

	1909	1910	1911	1912	1913
Gas works, Paris and vicinity	14,000	17,500	19,600	20,600	22,300
Provincial gas works	4,000				
By-product coke ovens	22,800	26,000	29,000	33,000	37,500
Sewage disposal	11,300	12,200	12,000	12,000	12,200
Shale works	900	1,600	1,900	2,900	2,500
Various sources	500				
Total	53,500	57,300	62,500	68,500	74,500

TABLE VII.—*Sulphate of Ammonia Consumption.*

The following table gives the estimated quantity of Sulphate of Ammonia, and its equivalent in other forms of ammonia, consumed in the countries specified.

	United Kingdom. Gross tons.	Germany. Metric tons.	United States. Net tons.	France. Metric tons
1900	65,000	127,700	36,000	49,000
1901	68,297	168,000	43,700	43,300
1902	63,750	175,000	54,300	53,300
1903	71,700	172,500	58,650	53,900
1904	68,500	200,000	71,300	53,800
1905	75,000	213,000	80,600	56,380
1906	82,000	229,500	84,000	67,000
1907	87,500	240,000	130,000	81,000
1908	90,000	260,000	117,700	84,000
1909	87,000	274,000	146,700	78,500
1910	87,000	350,000	178,300	73,000
1911	89,000	370,000	230,400	84,000
1912	90,000	425,000	246,100	91,000
1913	97,000	460,000	262,000	95,000
1914	106,000		272,158	

The conversion of muriate to sulphate equivalent is made on the basis of 25% of ammonia in sulphate and 31.5 in muriate. The exports of muriate and of sulphate are practically negligible.

The consumption in the United States amounted to 272,000 tons, in round figures, as against 262,000 tons in 1913, an increase of 10,000 tons, showing that consumption progressed, even if production halted temporarily. The average price for the year is $54.20 per net ton, less by $8.66 than in 1913, and by $11.37 than in 1912. While their average indicates the condition of the market for the year fairly well, the pendulum has now swung upwards again, and under the influence of the short home supply and the high freights from England, it seems bound for new high levels.

France.—The figures for the sulphate of ammonia production of France are given in Table VI., on the authority of " L'Engrais." Unfortunately those for 1914 are not available, though it is reasanably certain that the total is less than the 74,500 metric tons produced in 1913, because of the general stagnation of industry arising from war conditions. The imports for the calendar year 1914 are officially given as 9,274 metric tons, and the exports as 2,077 metric tons.

Japan.—Japan, as in past years, remains the largest single customer of England, taking 87,776 tons, though not as much as in 1913. The total amount imported is given by a U. S. consular report as 117,368 tons for 1914. The figures for production for 1913 and 1914 are not yet available.

Formal Order Establishing 520 B. T. U. as Canadian Standard.

Under the provision of Section 1, subsection (c) of " The Gas Inspection Amendment Act," an Order in Council, dated June 26, 1915, has been passed, establishing the following calorific standard for the determination of the heating value of manufactured gas throughout the Dominion and regulations relating thereto, viz:

Regulations.—These regulations are to be construed in all respects to the provisions of the Act, and the several words, terms and expressions to which by the Act meanings are assigned, shall have herein the same respective meanings.

1. British Thermal Unit (B. T. U.) means the quantity of heat required to raise the temperature of one pound avoirdupois of water from 60 to 61° Fahrenheit.

2. There shall be provided and maintained in proper working order by the department at each departmental testing place suitable apparatus for testing the calorific power of manufactured gas supplied at such testing place, and such apparatus and the method of making the test shall be such as shall from time to time be determined by the Minister.

3. The following provisions shall apply with respect to the testings of calorific power made with the apparatus and at the test places provided in accordance with the requirements of the preceeding section:

(a) Any inspector of gas appointed under the Act may by means of the apparatus provided as aforesaid, test at the prescribed testing place at any reasonable hour the calorific power of the gas supplied at such testing place, but not more than one testing for calorific power shall be made on any one day except in the event mentioned in subsection (f) of this section.

(b) The undertaker may, if he so desires, on the occasion of the testing of the gas under the provisions of this section, be present, either in person or represented by some officer whom he may appoint; such representative, however, shall not interfere with the testing.

(c) The Calorimeter shall be so used as to yield the total heat which shall be developed by the complete combustion in moist (saturated) air of moist (saturated) gas, and the products of combustion shall leave the calorimeter at approximately the temperature of the inlet water.

(d) Subject to the provisions of the next preceeding subsection, the testing shall be made in the manner and under the conditions for the time being prescribed by the Minister.

(e) The result obtained by means of such testing shall be expressed in terms of British Thermal Units per cubic foot of gas, and shall be corrected for a temperature of 60° Fahrenheit and a pressure balanced by a column of 30 inches of mercury at the same temperature. The corrected result shall be the calorific power of the gas determined by the testing.

(f) In the event of the calorific power, on any testing, being found to be below the standard calorific power, the undertaker shall be immediately notified in writing, and a second testing shall be made on the same day, but at an interval of not less than one hour from the time of serving the notice on the undertaker, and the average of the two testings shall be the calorific power of the gas on that day.

(g) Any party may, at any reasonable time, after depositing the fee, demand a test of the calorific power of the gas supply. In the event of the calorific power determined by the test being below the standard, the cost of the test shall be paid by the undertaker, if at or above the standard, by the party demanding the test.

(h) The Inspector shall, not later than the day following that on which any testing has been made under this section, make and cause to be delivered to the undertaker a report of the results of his testing, and such report shall be received as prima facie evidence of the facts therein contained.

Standard of Calorific Power.—4. The standard calorific power of the gas supplied by the undertaker at the prescribed testing place, shall be 520 British Thermal Units per cubic foot of saturated gas, when burned in saturated air, and the volume of gas corrected for a temperature of 60° Fahrenheit and a pressure balanced by a column of 30″ of mercury at the same temperature.

Provided, that the undertaker shall not be liable for more than one penalty in respect of a deficiency of calorific power of the gas at any testing place on any one day.

Penalties for Deficiency of Calorific Power.—5. If, on any day the calorific power of the gas tested in accordance with the provisions of these Regulations is below the standard calorific power prescribed, the undertaker shall be liable to the following penalties:

(a) Companies having over ten thousand (10,000) meters, $80 for the first offence and double this penalty for each subsequent offence.

(b) Companies having five thousand and one to ten thousand (5,001 to 10,000) meters, $60 for the first offence, and double this penalty for every subsequent offence.

(c) Companies having two thousand and one to five thousand (2,001 to 5,000) meters, $40 for the first offence, and double this penalty for every subsequent offence.

(d) Companies having one thousand and one to two thousand (1.001 to 2,000) meters, $20 for the first offence, and double this penalty for every subsequent offence.

(e) Companies having one thousand (1,000) meters and under, $10 for the first offence, and double this penalty for every subsequent offence.

Saving Clause as to Penalties.—6. Notwithstanding anything contained in these regulations, no penalty shall be incurred by the undertaker for any deficiency in calorific power in the gas tested in accordance with the provisions herein contained in respect of which the Inspector reports, or it is proved, that such deficiency was produced by any circumstance beyond the control of the undertaker; Provided, that want of sufficient funds shall not be held to be a circumstance beyond the control of the undertaker.

Procedure.—7. All penalties imposed under the authority of these regulations shall be recovable on summary conviction in accordance with the provisions of Sections 62, 63 and 65 of the Gas Inspection Act, Chapter 87 R.S.

8. These Regulations shall come into force and be operative from and after the first day of July, 1915.

9. All previous Orders in Council and Regulations relating to the testing of the illuminating power of gas, and in respect of sulphur and ammonia tests, are hereby repealed.

MOTOR FUELS.

The Situation in England, and on the Continent,—Gasoline Composition.—Tests for Quality.—Gasoline Substitutes.

From the Fothergill Lecture by PROFESSOR VIVIAN B. LEWES.

Great as had been the increase in gasoline imported into the United Kingdom between 1905 and 1912, the average increase was only about half of that for the years 1913 and 1914, last year's imports reaching the enormous valume of 120,000,000 gallons in spite of the disturbing influence of the war.

The demand for it is so true an index to the growth of motor traction that it is interesting to tabulate the amount imported during the last 10 years:

Year.	Gallons.	Year.	Gallons.
1905.....	18,000,000	1910.....	55,000,000
1906.....	25,000,000	1911.....	70,000,000
1907.....	34,000,000	1912.....	80,000,000
1908.....	40,000,000	1913.....	101,000,000
1909.....	53,000,000	1914.....	120,000,000

It is seen that since 1908 the use of gasoline has trebled. Moreover, in the last 2 years there has been a considerable volume of benzol, shale spirit and other substitutes employed, which would probably add to the consumption for each of these 2 years 10,000,000 gallons.

It might be supposed that the increase during 1914 was largely because of the enormous volumes used in the war for transport, aviation and other purposes, but the fact is that up to the middle of August the imports were 80,000,000 gallons, and therefore no sudden increase in supply has manifested itself due to war demands; whilst it must be remembered also that these quantities do not include the Government supplies, which in 1914 amounted to 170,000,000 gallons, chiefly no doubt fuel oil, but also probably partly gasoline.

The titanic struggle which is convulsing Europe has demonstrated the importance of the motor in war, as giving mobility to the troops and keeping up communications between the base and the front. Large as were Germany's stores of gasoline at the commencement of the war; Russia's conquests in Galicia and the cessation of supplies from Roumania have cut off the chief means of replenishing them; the pinch is beginning to be felt, and may play a unimportant part in bringing the war to a conclusion.

Enough gasoline must be kept for aviation, and it must be as light a spirit as possible; benzol is dangerous owing to its crystallizing at low temperatures, so that at great altitudes failure in the warming of the feed system by the exhaust might bring down the machine, and in any case light spirit is needed for priming in starting. The forced economy of gasoline is already hampering the transport work in the enemy's lines, and benzol and alcohol are being used as far as possible; but in the carbonization of a ton of coal in the Westphalian coke ovens two gallons of benzol is a liberal estimate, so that the problem of motor fuel is a very real one to the enemy, whilst England and France can get all they need from overseas, and Russia can get her supplies from Baku and the other oilfields on the Caspian, whilst if more is needed Galician and Roumanian supplies probably would be available. Germany has devoted more attention than any other country to the use of alcohol as a motor fuel—for some years her postal vans were run with it; but her alcohol is mostly made from potatoes, and the demand on this crop for food leaves none available for fermentation.

Crude petroleum as it comes from the well, undergoes a process of fractional distillation, the portion coming over below 150° C. being called benzene; and before the demands for motor fuel were so great as to tax the efforts of the producer, this fraction was divided by distillation into spirit for dry-cleaning, gasoline and solvent spirit, the gasoline having a specific gravity of 0.68, and being so volatile that starting troubles were unknown. Now to meet the demand practically all the benzene is sold as gasoline, the specific gravity being about 0.72, with the result that starting on a frosty morning is by no means a simple performance. The amount of benzene in the crude oil varies with the oil field, some, like the oils of Sumatra, Borneo, Roumania, Pennsylvania, Kansas and Illinois, containing from 14 to over 30%, whilst the Californian and Texas oils rarely reach 5%.

Our chief sources of supply during the past 2 years are shown in the table:

Imports of Gasoline in Millions of Gallons.

	1913.	1914.
Dutch East Indies.....	52	57
United States.....	24	41
Russia.....	13	10
Roumania.....	6	6
Mexico.....	1.5	2.5
Other countries.....	4.5	3.5
	101.0	120.0

This shows the enormous increase in the importation from the United States, which has made up for the cutting off of the supply from Russia and Roumania since August last; and also that the supply from Roumania was so much during the early months of the year that her total for 1914 is as high as for 1913.

Gasoline from crude oil ordinarily consists of a mixture of the first five liquid members of the paraffin series, all of which boil below 150° C., and its special gravity and volatility depend upon the proportions of these compounds.

The Volatile Liquid Paraffin Hydrocarbons.

	Formula	Boiling point.	Specific gravity.
Pentane.....	C_5H_{12}	37°C	0.628
Hexane.....	C_6H_{14}	69	0.664
Heptane.....	C_7H_{16}	98	0.700
Octane.....	C_8H_{18}	125	0.719
Nonane.....	C_9H_{20}	136	0.741

The gasoline at first imported had a specific gravity of 0.680, and consisted of a mixture of the first three; octane then began to appear in the spirit, and the specific gravity rose to 0.700; for the last few years nonane has also been present, and the specific gravity had been 0.72 and over. It must not be assumed that all gasoline consists of these saturated hydrocarbons only, as in "cracking" heavier petroleum into more volatile ones, some of the paraffins are changed into unsaturated hydrocarbons which, although as volatile, are of a heavier specific gravity; and the demand has led to methods of distillation that increase the normal yield at the expense of the heavier portions of the oil, so that it is possible to have gasoline of higher specific gravity than nonane itself, and it is a mistake to suppose that the specific gravity of a motor fuel is a guide to its value. Benzol, which is an excellent motor fuel, has a specific gravity of 0.886, which in a paraffin hydrocarbon would have meant a heavy residual oil of no use as a motor fuel except in a Diesel engine.

One important consideration in comparing the value of motor fuels is the amount of energy that can be stored in the gasoline tank, of which we know the capacity in gallons. The calorific value of various grades of ordinary gasoline differ but little. The average results of experiments, in spite of what one would expect from calculation, often show a higher calorific value for the lighter grades of spirit, as

Specific gravity.	B. T. U. per lb. net.
0.680	18,900
0.700	18,700
0.720	18,500

which might give the impression that the lighter spirit was the more valuable. However, it is heat units per gallon that interest us, and our figures become:

Specific gravity.	B. T. U. net per gallon.
0.680	18,900 × 6.8 = 128,520
0.700	18,700 × 7.0 = 130,900
0.720	18,500 × 7.2 = 132,200

And for practical purposes ordinary gasoline of specific gravity about 0.720 have a thermal value per gallon of 132,500 B. T. U. net and 144,000 gross.

The gross heating value of a fuel is the total heat evolved by the complete oxidation of its combustable constituents; whilst when

hydrogen is one of these it burns to water, the vaporization of which renders latent a portion of the heat evolved, and if the steam escapes with the other products uncondensed this heat is lost, and the net calorific value of the fuel is the total heat of combustion minus the latent heat of the water vapor formed. In the internal combustion engine the water formed by the combustion of the hydrogen of the gasoline escapes as steam, so that it is the net calorific value that is important.

In estimating the value of a motor fuel, calorific value is not the most important thing to consider. Often the efficiency of the engine may bo increased, owing to the fuel allowing of high compression or other factors that tend to the better conversion of the heat units into power, that a fuel relatively poor in calorific value may be nearly equal to one of far higher thermal units.

One point that always must be taken into consideration is the vapor tension of the liquid, as this governs its power of evaporation, and upon it depend ease in starting and flexibility in running.

A good motor fuel must give off enough vapor at low temperatures to form an explosive mixture in the cold cylinders of a car.

When a crude oil is distilled the fraction which comes over up to 150° C. is called "benzene," and contains the most volatile portions. The fraction from 150° to 300° C. is called " kerosene," the ordinary illuminating oil. The lower fraction can be redistilled, and if the specific gravities and vapor tensions of these fractions be taken it will be found that the vapor tension falls as the specific gravity rises

Specific gravity.	Vapor tension in mm. water at 15° C.
0.650	2,110
0.680	1,185
0.695	930
0.735	410
0.756	125
0.762	85
0.772	40
0.788	15
0.812	0

These figures show that an oil having a specific gravity of 0.812 (corresponding to kerosene or lamp oil) cannot be used alone as a motor spirit, because when the temperature was 15° C. the engine would never start, as no vapor would be given off to make the explosive mixture with air.

The scientific methods of determining the vapor tension of a liquid is too complicated for the ordinary observer; but he can judge how satisfactory a motor fuel is likely to be by means of a simple apparatus devised by Sir Boverton Redwood and Captain Thomson, whereby the relative volatility of spirits is determined by the pressure developed in a closed vessel on increase of temperature.

The apparatus consists of a thick-walled glass tube of small bore, about 30" long, the lower end turned up and widened into a cylinder, about 6" long and 1" in diameter, with a short length of glass tube on its upper end. The long tube is graduated in inches and tenths, and the cylinder is provided with two marks, the lower corresponding with the zero of the scale and the upper at nine-tenths of the capacity of the cylinder above the lower mark.

In use, a short length of stout rubber tubing is wired to the tube at the top of the cylinder so as to cover it entirely and project about ¾" above it. Mercury is poured into the cylinder up to the lower mark, and care is taken that the mercury thread in the capillary tube is not broken. The liquid under test is poured into the cylinder to fill it well up to the upper mark, and the apparatus is clamped vertically in a vessel of water at 50° F. After sufficient time has elapsed to allow of this temperature being attained by the apparatus and its contents, the level of the liquid is corrected, if necessary, and the rubber tubing is closed by a pinch cock just above the top of the glass tube, the open end of the india rubber tube being further closed by a glass stopper. The whole apparatus is then immersed above the top of the rubber tube in water at 50° F. The temperature of the water is raised very slowly, unequal heating being avoided by a mechanical stirrer. As the temperature of the water rises the height of the mercury in the capillary tube is read off at every 5° F. rise, the heat being so regulated that this rise takes about ten minutes.

In this way a comparison can be made between the vapor pressure of various substitutes for gasoline, if they are of the same kind of hydrocarbon, as we know that gasoline, such as Pratt's "Perfection," give only just the necessary starting power on a cold morning, and that anything that gives a vapor pressure less than that will give trouble in starting.

In the following table some pressures are given:

Vapor Pressure in Inches in Mercury.

Temperature F.	Pentane.	Pratt's spirit.	Benzol.	Alcohol	A.	B.
55	1.4	0.7	.1	.3	.4	1.0
60	2.0	1.4	.7	1.1	1.1	2.6
65	3.8	2.6	1.5	1.8	1.9	4.2
70	5.8	3.6	2.5	2.7	2.8	6.4
75	8.0	4.8	3.5	3.6	3.8	8.9
80	10.4	5.9	4.5	4.7	4.9	10.9
85	13.1	7.1	5.5	5.75	6.2	13.4
90	15.9	8.2	6.4	6.9	7.1	15.6
95	18.9	9.3	7.3	8.0	8.1	17.6
100	22.3	10.5	8.4	9.2	9.0	20.5

We know from experience that Pratt's spirit, with an air temperature of 60° F., starts without trouble, and so would the benzol and the two cracked spirits marked A and B. But nothing would make the alcohol start at that temperature, although it shows a higher vapor pressure than the benzol, and this is due to the percentage of combustible vapor in the mixture in the cylinder that will explode with electrical ignition. In the case of the benzol, it needs only 2.7% of vapor to give explosion, whilst with alcohol there must be at least 4%, so that although its vapor pressure is higher than that of benzol it does not vaporize sufficiently quick to reach the proportion of vapor needed.

When combustible vapors are mixed with air the maximum of chemical action—that is, the complete oxidation of the carbon and hydrogen of the combustible into carbon-dioxide and water vapor—gives the greatest energy of explosion. This point is an unalterable ratio of the vapor to air, and varies only with variation in the composition of the combustible body. On each side, however, of the percentage of vapor that gives the maximum effect there is a range over which the mixture is still explosive.

The percentage over which the mixture is explosive is called the " explosive range," and varies slightly according to the method of ignition, and figures given for electrical ignition are:

Explosive Range of Air-vapor Mixtures—Electrical Ignition.

Acetylene..	3.2 to 52.2	per cent.; range	49. per cent.
Ethylene...	4.2 to 14.5	" "	10.3 "
Alcohol....	4.0 to 13.6	" "	9.6 "
Ether.....	2.9 to 7.5	" "	4.6 "
Benzol.....	2.7 to 6.3	" "	3.6 "
Gasoline....	2.5 to 4.8	" "	2.3 "

When ignited by a flame a smaller proportion is combustible with explosion.

The wider the range over which the spirit will form an explosive mixture, the more elastic will be the proportion of air, and we all know the trouble caused when a sudden change in heavy traffic stops the engine by throwing the mixture outside the explosive limits.

Another essential test for motor spirit is a fractional distillation, to ascertain the proportion of hydro-carbons present, vaporizing at a sufficent low temperature to ensure complete combustion in the cylinder; and with gasoline of ordinary character, 90% ought to distil over below 150° C.

Great care has to be exercised in standardizing the method employed. The most satisfactory method is to take a short-necked Jena glass flask and a 5-bulb Young dephlagmator, with a thermometer so arranged that the bulb is just below the level of the side tube. A uniform rate of distillation must be maintained, and the temperature is noted at which the first drop leaves the end of the side tube. From that moment the volume collected through each 10° should be noted, and the distillation carried up to 150° C.

When distilling gasoline substitutes, the results will generally give a good idea of the constituents, which can be confirmed by taking the specific gravities of the main fractions. The fractionation of Pratt's spirit is shown as an example of a true gasoline:

Fractionation of Pratt's Spirit.

Specific gravity	0.7088	
First drop at	30° C.	
Below 50° C.	1.50	per cent.
" 60°	7.25	"
" 70°	19.25	"
" 80°	28.75	"
" 90°	42.25	"
" 100°	57.25	"
" 110°	70.25	"
" 120°	70.50	"
" 130°	86.50	"
" 140°	91.00	"

It must, however, be understood that it is possible to use mixtures in which some fractions distil as high as 250° C., if sufficient spirit distilling below 100° is present to give ease in starting and the necessary flexibility in working.

When gasoline was first introduced it seemed probable that its high volatility, and the fact that the vapor was highly inflammable and formed a violently explosive mixture when mixed with air, might make its use dangerous. The reason for so few accidents is the high temperature needed to ignite the vapor, either alone or mixed with air. Experiments made by Sir Boverton Redwood showed that the vapor could not be ignited by the glowing spark on a splint of wood, a red hot piece of coke, or a shower of sparks from a flint and steel; and experiments I have made shows that the ignition point is in the neighborhood of 1,200° C. How often have we seen a careless chauffeur filling the tank of his car while smoking a cigarette, a proceeding which, had the igniting point been as low as that of an ordinary combustible, such as paper, wood or coal, would have led to disaster.

The necessary temperature to cause ignition, although never reached by a glowing body, is attained with the smallest of flames, and throwing a lighted match on a surface over which gasoline vapor is flowing has caused many serious fires. The high ignition point of the explosive mixture of gasoline and air explains the necessity for a high density spark for igniting the mixture in the cylinder.

The volume of vapor yielded by gasoline depends upon its composition, the variation between the various constituents being shown in the following table:

Volume of Vapor from Hydrocarbons.

	Specific Gravity	Boiling Point	Cubic Feet of Vapor Per Gal.	Cubic Feet of Vapor Per Lb.
Pentane	.626	37.6° C.	31.2	4.9
Hexane	.664	69°	27.7	4.1
Heptane	.700	98°	25.7	3.7
Octane	.719	118°	22.6	3.1
Nonane	.741	136°	20.8	22.9

The higher the specific gravity the lower the gas yield.

In considering the price of gasoline we must not lose sight of the handling it has to undergo from its distillation until it reaches the consumer. It has to be piped from the refinery into the tank steamers that bring it to the English ports, and there all of these operations cause loss, and the transport is costly.

From the docks the gasoline is distributed in tins or drums or in bulk by barge to the various big companies, where elaborate precautions have to be made to ensure safety. The cost of storage and distribution from Thames Haven is given as 5d. per gallon, and the tax 3d.; the price of the spirit is inflated largely by these charges, and its cost at the point of production must be very low to admit of the large profits which undoubtedly are made. These extra charges for distribution, are often forgotten or insufficiently allowed for in considering the price at which various motor substitutes can be sold.

Prior to the demand created for it by the coming of the motor-car, gasoline was almost a waste product; it had to be distilled off from the crude oil before the kerosene, which in those days was the important product, could be obtained of a flash-point to satisfy legislative requirements, and the uses to which it was put were chiefly as a grease solvent for wool and dry cleaning, a little also being used in flare lamps and for sponge lamps. When a demand for it as fuel in the internal-combustion motor first arose the supply was more than sufficient to meet it, and prices rose but slowly, the bulk of the gasoline imported into England coming from America.

Before the price had been seriously inflated the Dutch East Indies came into competition with the American supply, and this tended to keep down the cost, but the use of gasoline in America was growing faster than it was here, the quantities used became enormous, and as it was necessary to fill home requirements the amount available for export to England became smaller. The Dutch East Indies then became the chief source of supply, so that in 1912 more than half the motor fuel used in England came from there. The falling-off of the American competition and the freight difficulties led to rapid rise in price, but in 1914 the American exports of gasoline to England suddenly rose again to 40,000,000 gallons, due to three causes — first, the closing of the German market; secondly, increased shipping facilities; and, lastly, the production of enormous quantities of spirit by cracking residues.

When the price of gasoline threatened serious harm to the motor industry, attempts were made to find substitutes and naturally benzol suggested itself, the first member of the aromatic hydrocarbon series, produced in the tar formed during the destructive distillation of hydrocarbons at a high temperature.

Benzol was discovered by Faraday in the liquid condensed by pressure from oil gas, and had little use until the discovery of aniline dyes by Perkin, who made aniline by nitrating benzol and reducing the nitrate by nascent hydrogen. This created a demand for benzol, which rapidly rose in price from that of an almost worthless by-product to the neighborhood of 15s. a gallon, and led to the perfection of the methods of distillation for extracting it from coal-tar, and also to experiments to obtain it by cracking oil residues and scrubbing rich gases.

A little later the Germans introduced recovery plants in the Westphalia coke ovens, and this gave such an increase in the supply that the price fell almost as rapidly as it had risen. After some years English prejudice against recovery oven coke began to be overcome, and plant applied to English coking, largely increasing the yield of benzol. This caused a further reduction in price, and ten years ago benzol could be obtained in large quantities at 6d. per gallon. Under these conditions it appeared to be an ideal motor fuel. Unfortunately, however, the supply, which had been more than ample for the demands of artificial color production and its other uses, proved utterly inadequate when it came to entering into competition with gasoline as a motor fuel. An immediate rise in the price occurred, and, as must always be the case, its price became only just sufficiently low to give it an advantage in competition, while the anticipations of certain enthusiastic supporters of benzol and wild statements as to the amount produced led to fallacious expectations as to the position it would take in the market.

The truth about benzol is that per ton of coal carbonised in the manufacture of coal gas and in coke ovens having recovery plants, the average yield of crude benzol per ton would not exceed $2\frac{1}{2}$ gallons, nearer $2\frac{1}{4}$: and before this is available for motor-car work it has to be purified and redistilled, not more than 72 per cent. of the original remaining, or a yield of motor fuel per ton of coal of 1.8 gallons.

During the year 1912 ten million gallons of crude benzol were produced in England, of which 4 millions were exported for the foreign color trade. Activity in building recovery plants then took place, and in 1913 the yield of benzol rose to 15 or 16 million gallons, about 5 millions being exported. Last year the increase in coke-oven recovery plants was checked by a slump in pig iron, the demand for metallurgical coke depends upon iron and steel production, but the stoppage of exports to Germany in the last five months of the year probably brought the benzol available for use up to about the same level as in 1913.

Even now not much more than half the total coking of coal is done in recovery plants, and if all beehive coking ovens were abolished and all metallurgical coke made in recovery ovens, and all the tar made in the gas works was distilled and the benzol recovered, the total possible output for England would be 36 million gallons, or about one-third of the mator fuel imported last year.

The present overstocking of the metallurgical coke market is leading several collieries that produce a rich bituminous coal to considering adopting a lower temperature of carbonization than is used either in gas making or coke oven practice, as there is a market for a coke containing about 6% of volatile matter, which should be easy of ignition and burn in the domestic grate with a bright clear fire. The market for a gas of good heating value for power and commercial purposes is also becoming greater, and the demand for aromatic hydrocarbons is becoming insistent for the preparation of explosives, and they will be needed in large quantities if an attempt to capture the German coal tar dye industry is to be made, and with carbonization at 900° C., recovery of crude benzol from the tar, and also by scrubbing the gas with a heavy oil, it would be possible to obtain between 4 and 5 gallons of crude aromatic hydrocarbons per ton.

In speaking of the carbonization of coal as a source of motor fuel it must be borne in mind that with carbonization at 450° C., the yield of aromatic hydrocarbons, benzol, etc., is extremely low, their place being taken by light oils of the paraffin series and naphthenes; benzol and the further members of the aromatic series, are produced in maximum quantities by carbonization at about 900° C.

Benzol sold as motor fuel contains also toluol and xylol, these three being the first members of the aromatic series, and having the following composition and boiling points:

	Formula.	Boiling Point Degs C.	Specific Gravity.
Benzol	C_6H_6	80.5	.886
Toluol	$C_6H_5.CH_3$	110.0	.865
Xylol	$C_6H_4(CH_3)_2$	137–140	.87

(*Continued on page 170*)

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The Value of Frankness.

Joseph H. Brewer, president of the American Public Utilities Company, is a firm believer in publicity in the conduct of utility enterprises. In his annual report to his stockholders he referred to three publicity campaigns waged in behalf of as many of the company's subsidiaries.

One of the campaigns was at Indianapolis in behalf of the Merchants' Heat and Light Company, "for the purpose of giving the local public adequate idea of the importance of the company and its facilities for doing business." Another campaign was at Jackson, Miss., in behalf of the Jackson Light and Traction Company, to meet the threatened establishment of a municipal lighting plant; and according to the report, it "had the satisfactory result of assisting in producing an adverse vote of the people."

The third campaign is now in progress in the Wisconsin and Minnesota territory, its purposes being "to favorably influence the people in favor of water power development, the upbuilding of industries based on a supply of cheap electric power, and of a tolerant and friendly consideration for enterprises that seek to make the natural resources of the district a source of betterment to the community as well as to investors in such development."

"Our theory is that the people are entitled to know all about the public utilities that serve them. In all our campaigns we have laid the books wide open on the table and there has been nothing the people wanted to know that we have not told them," said Mr. Brewer. "We have found this not only the best way, but it is really the only way to do business. The great mass of the people are fair, or at least want to be fair, and when we take them completely into our confidence, we have nothing to fear from agitators or from those who misrepresent facts and conditions.

"Our campaigns are conducted through the newspapers, in the form of friendly, frank statements and every statement made is backed by facts. We never claim to be philanthropists, but freely admit that we want a reasonable return on the money invested. We endeavor to show the public that our interests and theirs run along the same lines, that we cannot give good service when operating at a loss, and that poor service is not to the advantage of the community."

Illuminating Engineering Society Convention.

The Ninth Annual Convention of the Illuminating Engineering Society will be in Washington, D. C., starting Monday, September 20. Headquarters will be at the New Willard Hotel.

The papers' program touches every important phase of illuminating engineering, and surpasses even the high standard set in former years. So many papers have been offered, that even after selecting the best, it has been necessary to exclude a number of excellent papers for lack of space. Besides a goodly number of papers on scientific subjects, there are an unusual number directly applying to the practical problems of men interested in the commercial side.

Washington is an ideal city for conventions, and if you have never seen Washington in September, it would be worth your while to go for this alone.

Special plans have been made for the entertainment of ladies, and it is expected that there will be a greater number of ladies attending the convention than in previous years.

Papers and Reports.

Report of Committee on Nomenclature and Standards.

Report of Committee on Lighting Legislation.

Report of Committee on Research (Investigation of Methods of Heterochromatic Photometry).

Report of Committee on Progress.

The Lighting of Ships, H. A. Hornor.

The Lighting of a Passenger Steamer, H. T. Spaulding.

Life Testing of Incaadescent Lamps at the Bureau of Standards, G. W. Middlekauff, B. Mulligan and J. F. Skogland.

The Use of Portable Photometers, W. F. Little.

Compensating Illuminating Test Plates, C. H. Sharp.

Illumination Efficiencies as Determined in an Experimental Room, W. Harrison and E. A. Anderson.

Semi-Direct Office Lighting in the Chicago Edison Building, Wm. A. Durgin and J. B. Jackson.

Street Lighting with Gas Lamps, G. S. Barrows.

Arc Lamps for Street Illumination, H. E. Clifford.

New Types of Incandescent Lamps and their Relation to the Street Lighting Problems, W. H. Rolinson.

Application of Principles of Scientific Street Lighting, F. A. Vaughn.

How Can a Combination Gas and Electric Company Render the Best Service to the Customer, A. B. Spaulding and N. H. Potter.

The Selection of a Standard Unit for Commercial Lighting, W. R. Moulton.

Small Incandescent Lamps and Special Illumination Problems, R. P. Burrows.

Illumination and One Year's Accidents, R. E. Simpson.

The Application of Crova's Method of Colored Light Photometry to Modern Incandescent Illuminants, H. E. Ives and E. F. Kingsbury.

The Relative Photographic and Visual Efficiencies of Light Sources, L. A. Jones, M. B. Hodgson and Kenneth Huse.

A Method for Studying the Behavior of the Eye Under Different Conditions of Illumination, F. K. Richtmyer and H. L. Howes.

The Flame Pilot Ignition of Incandescent Gas Lamps, C. W. Jordan.

Practical Illumination as Exemplified by some Recent Installations of Incandescent Gas Lamps, R. F. Pierce.

Mercury-vapor Lamps for Industrial Lighting, W. A. D. Evans.

The Retinal Sensibilities Related to Illuminating Engineering, P. G. Nutting.

Vision and Brightness of Surroundings, P. W. Cobb.

A Flux Method of Obtaining Average Illumination, F. A. Benford and H. E. Mahan.

Artificial Illumination of Architectural Interiors, David Crownfield.

Artificial Lighting of Typical Offices in the State, War and Navy Department Building, W. E. Chapman.

Lighting in Downtown Office Buildings, A. O. Dicker and J. J. Kirk.

Present Practice in the Lighting of Armories and Gymnasiums with Tungsten Filament Lamps, A. L. Powell and A. B. Oday.

Ultra-violet Light and the Eye, W. E. Burge.

Production and Application of Ultra-violet Rays, M. von Recklinghausen.

The Parabolic Mirror, F. A. Benford.

Some Experiments on the Eye with Inverted Reflectors of Different Densities, C. E. Ferree and G. Rand.

The Effect of Variation of Atmospheric Pressure on the Candlepower of Flames, E. B. Rosa, E. C. Crittenden and A. H. Taylor.

Yellow Light, M. Luckiesh.

Artificial Illuminants for Use in Practical Photography, C. E. K. Mees.

Members are urged to lose no time in making reservations as the G. A. R. Reunion is to be held there, starting on September 27. A great crowd is expected, and it is probable that they will begin to come in just about the time of the Convention. Reservations may be made directly by the members with the hotels or through the Hotel Committee, as preferred.

The various railroads will run special cars on some of their best trains, arriving on Sunday, September 19.

PROGRAM OF THE TENTH ANNUAL MEETING OF THE AMERICAN GAS INSTITUTE, SAN FRANCISCO, CAL.

Tuesday, September 28, 2 to 5 P.M.

Institute Meeting.

Report of Board of Directors (including the following reports):
- Committee on Election of New Members, W. H. Gartley, Chairman
- Committee on Securing Members, H. C. Blackwell, Chairman.
- Secretary.
- Treasurer.
- Finance Committee, A. E. Forstall, Chairman.

President's Address.

Appointment of Committee on President's Address.

Report of Trustees Gas Educational Fund.

Reports from the following Committees:
- Nominations, A. M. Barnes, Chairman.
- Public Relations, G. B. Cortelyou, Chairman.
- Technical, Herman Russell, Chairman.
- Beal Medal, W. H. Gartley, Chairman.
- Arrangements, J. A. Britton, Chairman.
- Representatives U. S. National Committee of International Commission on Illumination, W. H. Gartley, Chairman.
- Accident Prevention, J. B. Douglas, Chairman.
- Bureau of Information, D. D. Barnum, Chairman.
- Carbonization, O. B. Evans, Chairman.
- Chemical Tests, C. C. Tutwiler, Chairman.
- Classification of Gas Engineering, W. H. Peck, Chairman.
- Gas Housepiping, C. E. Reinicker, Chairman.
- Gas Lighting, C. O. Bond, Chairman.
- Gas Works Auxiliaries, J. M. Spitzglass, Chairman.
- Meter Connections, W. K. Harrington, Chairman.
- Physical Tests, C. J. Ramsburg, Chairman.
- Pipe Joints, G. I. Vincent, Chairman.
- Pipe Standards, W. Cullen Morris, Chairman.
- Refractory Materials, Herman Russell, Chairman.
- Representatives on Joint National Committee on Electrolysis, J. A. Gould, Chairman.
- Supplying Large Buildings with Gas, O. H. Fogg, Chairman.
- Utilization of Gas Fuel Appliances, W. J. Serrill, Chairman.

Manufacturing Section.

Nominations for Section Vice-President.

Chemical Section.

Nominations for Section Vice- President.

Distribution Section.

Nominations for Section Vice-President.

Illumination Section.

Nominations for Section Vice-President.

Accounting Section.

Nominations for Section Vice-President.

ANNOUNCEMENT, CANADIAN GAS ASSOCIATION.

The Eighth Annual Meeting of the Canadian Gas Association will be held in Montreal, Quebec, on Thursday and Friday, September 16th and 17th. Headquarters will be at the Windsor Hotel, where ample accommodations are available for all visitors.

The morning of the 16th will be given over to a business session, and the presentation of some very interesting papers that have been prepared for the occasion.

On the afternoon of the 16th there will be a trip to the new Lasalle Gas Works, which should be of special interest to all gas men, as the new plant has been pronounced by many engineers one of the most up-to-date on the continent. Preparations have been made for the entertainment of the ladies by a trip up the mountain and through the parks.

On the evening of the 16th, there will be a theatre party for the ladies, and a smoker for the men.

The morning of the 17th will be devoted to the presentation of papers and final business; and at the conclusion of the session, members, visitors and ladies will be taken to the Golf Club for luncheon.

The following are the papers that have been prepared:

"Carbonizing with Verticals in Ottawa," by A. A. Dion, General Superintendent, Ottawa Gas Company.

"Some Difficult Work in Large Pipe Laying Under Lachine Canal and Adjacent Swamp," by Chas. H. Osler, Superintendent Distribution Department, Montreal Light, Heat and Power Co.

"A Motor Driven Gas Pump Installation," by John S. Haug, Montreal Light, Heat and Power Company.

"The Value of Mechanical or Other Indicating or Recording Appliances in Connection with the Several Operations of a Gas Plant," by Wilfred Philpot, Chemist, Consumers Gas Company, Toronto.

"Routine of Billing and Receiving Department," by W. P. Baird, Manager West Division Billing and Receiving Department, Montreal Light, Heat and Power Company.

MICHIGAN GAS ASSOCIATION MEETING.

The 24th annual meeting of the Michigan Gas Association will be held in Detroit on September 23 and 24. The members, and any other gas men that can make it convenient to attend, are urged to get to Detroit early on the evening of the 22d, as an entertainment is planned for that night, and only two days will be given to the sessions, instead of three.

The list of papers already arranged for is as follows:

"High Pressure Distribution for Small Plants," by Ralph B. Wagner.

"Recent Developments in the Doherty Washer-Cooler and Condenser Systems," by R. B. Rowley of the Semet-Solvay Company.

"House Maintenance of Gas Lighting," by Wm. O. Weeks,

"A Talk on Accident Prevention," by Chas. B. Scott.

"A Talk on the Welfare and Training of Employees," by C. L. Palmer of Detroit.

Then there will be a contribution from Professor Alfred H. White and his assistants at the University of Michigan, who are in charge of the experimental and research work carried on by the Michigan Gas Association through its Fellowships. This is always of value and interest to everybody in the gas business.

The banquet will probably be on the evening of the 23rd, and some unusually interesting speakers and other entertainment has been arranged.

The ladies attending are promised interesting entertainment for both days. There will be no dull minutes for anybody.

Further details can be had from Glenn R. Chamberlain, Secretary, Grand Rapids, Mich.

(*Continued from page 167.*)

Motor Fuels.

The general method adopted for separating benzol to be used as motor fuel from coal tar, consists in distilling the tar and subjecting the light oils to further fractionation, the lower boiling fractions being separated. These are purified by treatment with sulphuric acid, some of the sulphur and certain unsaturated hydrocarbons, etc., being removed. This is followed by treatment with caustic soda, by which tar acids, such as carbolic acid, are eliminated from the spirit, and finally a thorough washing with water is given. The treated and washed spirit is rectified in stills provided with a reflux apparatus, which allows the more volatile vapors to pass forward for subsequent condensation; the heavier vapors being condensed and returned to the still. In this way it is possible to collect a distillate of definite boiling point and specific gravity.

The demand which has arisen for toluol for the manufacture of trinitrotoluol, or T. N. T., employed as a bursting charge in the shells which give the smoke that has earned for them the sobriquet of "Black Marias," will undoubtedly lead to further fractionations, and reduce still more the proportion of benzol available as motor fuel.

Pure benzol, generally spoken of as benzene, has the drawback that it crystallizes at 6° C., but the other bodies present in the commercial 90% benzol used for motor fuel lower the temperature of crystallization, and the addition of 10% of gasoline will keep it liquid well below the freezing point.

For use in an ordinary motor engine it is exchangeable with gasoline—i. e., no alterations of carburettor or engine are necessary—and it develops about 12% more power. Unless properly purified, the smell of the exhaust is objectionable, and if the crude benzol without any purification is used, trouble is sometimes found from the formation of resinous bodies, which tend to cause sticking of the valves, etc.

The calorific value of benzol per pound is 17,750 B. T. U. gross, 17,100 net, considerably below that of gasoline, but its specific gravity is 0.886 or 8.8 pounds to the gallon instead of 7.2 with gasoline, the heat value per gallon is 156,700 B. T. U. gross which explains the 12% higher power obtained in use. Benzene is a definite compound, and although it contains some toluol and xylol, a far larger proportion fractionates over a narrow range of temperature than with an avowed mixture like gasoline. Pure bensene distils at 80° C., and the bulk of a commercial benzol distils between 80° and 100° C.

Another definite compound usable as a motor fuel, that will become of more and more importance as the world's supply of oil is depleted, is alcohol.

Ethyl alcohol, C_2H_6O, is obtained by alcoholic fermentation from almost any material containing cellulose—corn, rice, potatoes, sugarcane, beets, wood refuse, and even sawdust—and no country is without material from which it could be produced. It is in many ways an excellent motor fuel; its limitations are known, and the possibility of using it is purely a question of Government sanction. The great curse of alcohol is that it is an intoxicant, and that Government finds in taxing it a fruitful source of revenue. When it must be used as a fuel it can be made at 6d. per gallon, but its manufacture and use are so hampered by restrictions that the denatured or methylated spirit costs 2s. 4d. to 2s. 8d. per gallon, and under these circumstances gasoline would have to rise to about 3s. 6d. a gallon before alcohol could compete with it.

The denaturation or methylation of alcohol consists in mixing with it something that cannot be again separated easily, and which will render the mixture so nauseating that no one can drink it—in theory. As the law stands, only what is termed "mineralized methylated spirit" may be used as a motor spirit; it consists of alcohol (96% strong) mixed with one-ninth of its volume of wood naphtha and not less than three-eighths of 1% of petroleum, which renders it turbid if mixed with water. Wood naphtha or wood alcohol, CH_4O, is obtained from the pyroligneous tar yielded by the destructive distillation of wood, and its use for denaturing alcohol is one of the chief objections for the use of alcohol for motor purposes, that it causes corrosion of valves and other working parts. This, however, is not the case when other denaturants are used; but there is a strong probability that if an engine is running light, and the temperature is low, partial oxidation might lean to the formation of an aldehyde, which might be converted into acetic acid.

The fact that the molecule of alcohol contains oxygen affects its calorific value, methylated spirit having not much more than half that of .722 gasoline, so that if merely the thermal values of the two fuels are taken as representing their production of power, alcohol would not have a chance of competing with gasoline.

I have already pointed out that the thermal value of a fuel is not a safe guide to the work it will do, and alcohol is an excellent example of this. The efficiency of a good gasoline motor is 22, that is to say, only 22% of the heat value of the gasoline is converted into work, and the loss is dependent upon a large number of factors, such as the compression that can be used without fear of premature ignition, the air needed for complete combustion, the cylinder temperature, and other points. With gasoline a compression of more than 70 pounds is unusual, for fear of preignition, although it is sometimes carried to 90 pounds; but with alcohol, compressions as high as 200 pounds can be employed. A pound of gasoline requires 15 pounds of air for its complete combustion; with alcohol only 8.75 pounds are needed, which means that the volume of inert nitrogen in the air, which has to be heated to the same temperature as the other cylinder gases, and which acts as a diluent in slowing down combustion, is reduced by nearly one-half in the case of alcohol. Further, the explosive range for gasoline is extremely low, so that it is difficult to get the exact explosive mixture; but with alcohol the range is more than doubled, while the explosion, being much cooler than for gasoline, the cylinder temperature is not so high; all these factors being to the advantage of alcohol, we find that the efficiency of the engine using it can be increased to as high as 38%, and in trials with properly constructed engines results with alcohol, volume for volume, are very nearly equal to gasoline.

As regards safety, alcohol has an advantage over gasoline; its flash-point, instead of being below the air temperature, is 58° F., so that instead of a summer's day causing volumes of vapor to be given off, as withg asoline, the evaporation is comparatively slow; it does not creep like gasoline does, and being much lighter than gasoline vapor does not flow over the ground in the same way, and being miscible with water, if it catches fire it can be easily extinguised.

In France considerable attention has been paid to the utilization of alcohol in motor-cars; and so important was it considered in Germany that the manufacture of alcohol by fermentation from potatoes was State-aided; and alcohol for motor use became a commercial success, the benefits of which are being reaped at the present time, when a gasoline famine exists.

Our interest in gasoline substitutes may be summed up as a desire to get a motor fuel cheaper than gasoline; but an object-lesson in what we could do if gasoline and petroleum products failed, is seen in Germany's plight at the present moment.

The whole war depends on motor traction—without it the movement of troops is hampered, the commissariat cannot be carried out properly, the supply of ammunition to the fighting line fails, and the Red Cross Service is rendered inefficient. There is practically a gasoline famine, and what there is must be kept for the fighting line and the air service. Under these conditions the Germans experience in using alcohol as a motor spirit is proving of great value. Every motor-car in Germany has been adapted to burn alcohol as well as gasoline by fitting carburettors adaptible to either fuel, that when used with alcohol can be warmed for starting. We have seen that the thermal value of alcohol is only a little more than half that of gasoline, but that higher compression is possible and makes the efficiency nearly the same; but the compression cannot be altered without alterations to the engine that would unfit it for use with gasoline, while if alcohol is used in an engine arranged for gasoline the power obtained would follow the ratio of their heating values. Nearly twice as much alcohol as gasoline would have to be burnt to give the same power. To get away from these troubles without any more alteration than the carburettor, a mixture of alcohol with benzol, in which naphthalene has been dissolved, to give it higher heating power, is used. The favorite formula is:

95 % alcohol	80 litres.
Benzol (with 200 grammes naphthalene dissolved in it)	20 "
	100

This mixture, without any extra compression, gives five-sixths the power of gasoline, and all the ingredients are made in the the country.

It will be interesting to see how much such motor fuel can be possibly made in Germany.

In 1913 she produced 160,000 tons of benzol, of which 50,000 were exported; all exportation has now ceased, and if production has maintained and one-third recovered from the crude benzol as toluene, this would leave about 100,000 tons of benzene, or 25,-

000,000 gallons, which, with the amounts used at both fronts and in the towns, would be, at most, 6 weeks' supply.

Her production of alcohol in 1913 was 82,500,000 gallons, so if all the benzol and alcohol made in the country were blended and naphthalene dissolved in it, the whole production of motor fuel would be about 5 months' supply at the present rate of consumption.

Leaving the simple compounded motor fuels, we come to a class of mixtures in which heavier portions of the crude oil is used.

In the distillation of crude oil the second cut consists of kerosene distilling between 150° C. and 300° C., and its volume is, of course, enormously greater in nearly all crude oils than the benzene or first cut. The demand for it is still very large, the amount imported into England last year being 146,000,000 gallons, or some 26,000,000 gallons more than gasoline spirit.

Five or six years ago oil of this character cost 3d. to 4d. per gallon, whilst gasoline was already over 1s.; and many attempts were made to mix it with benzol or gasoline in sufficient quantities to allow of starting, and when the temperature of the cylinder got sufficiently high, and a good spray carburettor was used, mixtures the right proportions, worked well as long as used for steady running without any great fluctuation in speed. However, directly one got into heavy traffic, troubles began to show, as the range over which the mixture of kerosene spray and air is explosive is even more narrow, indeed not more than one-half that of gasoline-air mixtures.

There must have been twenty or thirty patents taken for such mixtures, their nature disguised by the introduction of small quantities of other substances which generally had no effect whatever, or by fantastic methods of treating and purifying the mixture before use. Even kerosene can be used by itself in a motor engine with an atomizing carburettor if all the working parts are sufficiently hot when it is turned on and nothing happens to alter the ratio of oil to air. Several attempts have been made to utilise this fact by fitting double tanks and carburettors to cars, so as to start on gasoline, and when warmed up switch on the kerosene, when the engine would run well until the supply was throttled, when the engine would stop dead, owing to the proportion of oil vapor to air being thrown outside the narrow explosive range.

I have experimented on such mixtures, and for anything approaching satisfactory work the gasoline has to be practically half the mixture, and when, as at present, the price of kerosene is high very little saving is secured.

Perhaps the most successful mixture of this class is 50% of kerosene distilling up to 250° C., with 40% of gasoline of .720 specific gravity and 10% of benzol; the idea being that in a mixture of liquids of different boiling points the escape of the vapor of the most volatile constituents carries with it considerable proportions of the ingredient of next higher boiling point, this again helping the volatilisation of the still heavier fractions. Also if a carburettor is used that sprays the mixture as a fine mist into the cylinder, each particle of the mist will be a drop of microscopic size containing all the constituents of the mixture, and as the more volatile portions of each particle evaporate the particle is reduced rapidly in size, until the last portion of the heaviest oil is so finely divided that its complete combustion is easy. I think that for commercial work mixtures of this character might often be employed. The rate of flame propagation in the mixture is a question that must not be overlooked, as if the rate of burning is made progressive, it is obviously not fitted for very rapidly running engines, as a slow burning mixture might not complete its combustion by the time the inlet valve opened, and firing back would take place. It seems probable that the admixture of oxidizing agents with heavier oils renders them easier to burn in a motor, and in France it is a usual practice to mix small quantities of picric acid and other nitrated hydrocarbons with the oil.

It has been claimed that the admixture of small quantities of hydrogen peroxide exerts a remarkable influence on the way they burn, and enables heavier fractions to be used successfully. With all this class of motor fuels, starting from cold and flexibility in running have been the main troubles, and excellent results have been attained by the solution of hydrocarbon gases in them, which being readily disengaged, give the necessary ease of starting, and by having a wider range of explosion give the fuel flexibility. Of all the gases fit to use this way, acetylene is the best, having high calorific value, and adding to the power of the fuel; it is also fairly soluble in benzol and alcohol, and gives the mixtures the desired starting power from cold, and having the greatest known explosive range it adds flexibility in running. The right way to use it is to make a standard solution of the gas in benzol, one volume holding four volumes of acetylene in solution, and in making the motor fuel to add sufficient of this to give the necessary starting power.

I have known motor spirit containing a mixture of kerosene and gasoline, touched up with a benzol solution of acetylene, retain its starting power for nine months, showing that when in true solution there is little tendency to "stale," so common with mixture fuels. When alcohol comes into use as a motor fuel this property may prove of considerable value, as one volume of alcohol dissolves six volumes of acetylene.

Even hydrogen, the best soluble of all gases, has been used for treating ordinary gasoline, and is claimed to give a 20% saving in consumption. In this case the escape of the small quantity of hydrogen from the gasoline carries gasoline vapor with it, and as the igniting point of hydrogen is less than one-half that of gasoline vapor, it probably flashes through the gaseous mixture in the cylinder and causes a more rapid and complete combustion—acts like a priming of small grain gunpowder in a heavy charge of prism powder.

(To be continued.)

The Gas Show at Washington.

There will be no possibility of complaint on the part of exhibitors at the Washington Convention of the National Commercial Gas Association. Special efforts will be made to do them justice. To this end no morning sessions will be held, except on Thursday, Dec. 2d. This will give exhibitors and their representatives opportunity to attend the sessions of the convention, and will afford the delegates ample time to inspect the exhibits.

The Association has brought out emphatically before this, and now does so again, the desirability of placing orders with the exhibiting manufacturers. Convention after convention sees the manufacturers spending time, energy and money for the purpose of giving gas men the best possible idea of the appliances on the market. Their support has been unfailing; indeed it is not too much to say that they have been the largest factor in making the conventions possible, both financially and in the even more important department of stimulating interest and suggesting new ideas. They deserve recognition of this service at the hands of all gas men, and the Association wishes to encourage in every way possible a courteous and careful attention to the manufacturers' exhibits, and the prompt placing of orders with them by gas company representatives.

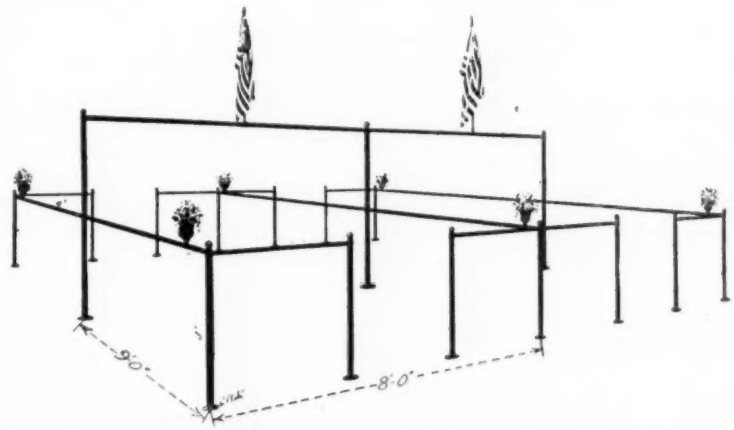

DIAGRAM SHOWING DETAILS OF THE 8'-0" x 9'-0" BOOTHS.

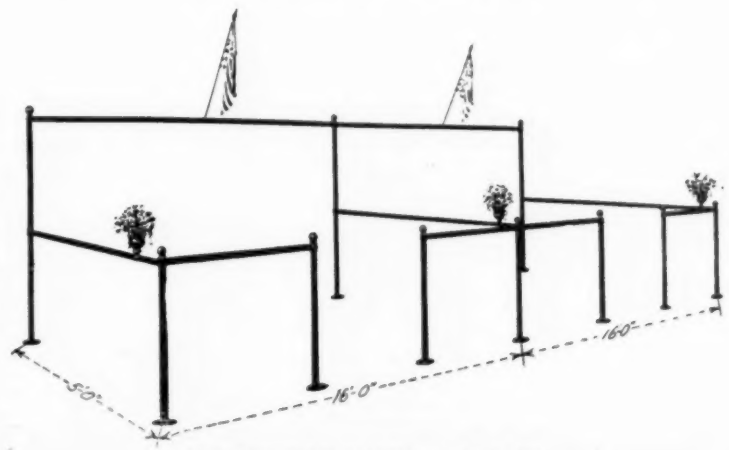

DIAGRAM SHOWING DETAILS OF THE 16'-0" x 5'-0" BOOTHS.

In this connection, it should be noted that the hotel management is opposed to exhibits in rooms, and it is unfair to those manufacturers who help support the Association.

Not more than a half dozen booths yet remain to be sold. The list of those who have engaged space is as follows:

A. B. Stove Co., Battle Creek, Mich.
The American Meter Co., New York City.
Baltimore Gas Appliance & Mfg. Co., Baltimore, Md.
Bayley & Sons, Inc., New York City.
The G. S. Blodgett Co., Burlington, Vt.
The Brassart Fixture Co., New York City.
George M. Clark & Co., Chicago, Ills.
The Crandall-Pettee Co., New York City,
William M. Crane Co., New York City.
Detroit Stove Works, Detroit, Mich.
Eclipse Gas Stove Co., Rockford, Ills.
Eriez Stove and Mfg. Co., Erie, Pa.
Estate Stove Co., Hamilton, O.
General Gas Appliance Co., New York City.
General Gas Light Co., New York City.
Gilbert & Barker Mfg. Co., Springfield, Mass.
The Hale Gas Mixer Mfg. Co., Neodesha, Kas.
Hale & Kilburn, Philadelphia, Pa.
Hays Mfg. Co., Erie, Pa.
Helme & McIlhenny, Philadelphia, Pa.
The Humphrey Co., Kalamazoo, Mich.
The Improved Appliance Co., Brooklyn, N. Y.
Lombard Governor Co., Ashland, Mass.
Long-Landreth-Schneider Co., New Brunswick, N. J.
The Lovekin Co., Philadelphia, Pa.
The Massillon Rolling Mill Co., Massillon, O.
Mead Gas Heater Co., Delawanna, N. J.
Meek Oven Co., Newburyport, Mass.
Milwaukee Gas Spec. Co., Milwaukee, Wis.
The Michigan Stove Co., Detroit, Mich.
National Stove Co., Lorain, O.
New Process Stove Co., Cleveland, O.
The Nighingale Co., New York City.
Peninsula Stove Co., Detroit, Mich.
Pittsburgh Water Heater Co., Pittsburgh, Pa.
Rathbone-Sard Co., Albany, N. Y.
Reliable Stove Co., Cleveland, O.
The Sentinel Mfg. Co., New Haven, Conn.
Reznor Mfg. Co., Mercer, Pa.
Roberts & Mander Stove Co., Philadelphia, Pa.
Ringen Stove Co., St. Louis, Mo.
Ruud Mfg. Co., Pittsburgh, Pa.
Safety Gas Lighter Co., Haverhill, Mass.
Issac A. Sheppard & Co., Philadelphia, Pa.
J. B. Slattery & Co., Brooklyn, N. Y.
Sill Stove Works, Rochester, N. Y.
Shapiro & Aronson, New York City.
Stack Heater Co., Boston, Mass.
Storrs Mica Co., Oswego, N. Y.
Strause Gas Iron Co., Philadelphia, Pa.
Thomas Roberts Stevenson Co., Philadelphia, Pa.
The Union Stove Works, New York City.
United Lead Co., New York City.
Utica Valve & Fixture Co., Utica, N. Y.
Weir Stove Co., Taunton, Mass.
Welsbach Co., Gloucester, N. J.

Recent Patent Issues.

Prepared for the American Gas Light Journal by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,145,188. Fixture for Gas Lamps. L. F. Franz, Dayton, O., assignor to the St. Clair Mfg. Co., same place.
1,145,327. Gas Generating Furnace. W. C. Loudon, St. Louis, Mo.
1,145,488. Gas Stove Heat Economizer. J. Kendall, Vancouver, B. C., Canada.
1,145,491. Packing Box for Mantles, etc. E. L. Knoedler, Gloucester City, N. J., assignor to Welsbach Light Co., same place.
1,145,500. Incandescing Burner. D. J. Monosmith, Spencer, O.
1,145,556. Machine for Sewing Mantles. S. Cohn, New York. N. Y., assignor to Mantle Machinery & Patents Co., same place.
1,145,601. Pressure Reducing Valve for Gas. L. Lemoine, Paris, France.

What an Association Can Do for You.

[From the paper by A. V. Wainwright, read to the Southwestern Gas and Electric Association.]

The title of this paper, "What the Southwestern Electrical and Gas Association Can Do For Me," is an indication of the statement of our secretary of the fundamental fact that the Association *is prepared and willing* to assist its members in every respect.

However, there is another point of view to be considered, which may best be emphasized by a slight change of title: "What the Southwestern Electrical and Gas Association *May* Do for Me." This implies three conditions: the need of knowledge or information, the desire to obtain this knowledge, and that it may be found in the Association's records or obtained through the medium of the office. The vital one of these is the second—"the desire to obtain this knowledge." We all need information in our business, our Association Office has proved its willingness and ability to obtain it for us, *but* what good is this if, in our need, we do not take advantage of our Association facilities? We pay our money to support the office, the secretary fills it with vital and practical information "on tap"—and we let it lie there unused, while needing it in our business!

The history of the organization is known better to the majority of its members than to the writer, yet attendance at last year's very successful meeting demonstrated only too clearly that the members were not using the tools at hand to bring about betterment in service, operating conditions and economics.

In order to ascertain if there was a reason for this in the office itself, certain data was requested from it relative to Public Policy, History of Electric Rates, Methods of Charging in Texas, and Costs and Uses of Underground Service in the Southwest, all of which subjects were very active in a certain company a short time subsequent to the 1914 meeting. A single request to the office immediately brought a mass of data that was invaluable and, when applied, saved that company many thousands of dollars.

Inquiry as to the use made by members of the data collected brought out the fact that few ever took the trouble to ask if a certain matter was of record. It seems to me that when one voluntarily joins an organization of this character and agrees to work under its constitution and by-laws, that it is up to him to do so in both letter and spirit. Not only is the Association an "information bureau" and the cause and being of these Conventions, but it is our *only* opportunity and opening for *full* co-operation among ourselves—the *only* medium we have for the full *mutual* benefit of every *class* and *kind* and *size* of public utility in the State.

This state of affairs doubtless is discouraging to the operator of the office, causes the Association to waste a valuable part of the assets that *ought* to be used for the benefit of its members and the public, and to justify and systematize many matters relative to our relations with the public; which matters, when handled by only one person and with the local viewpoint of the particular person and property, often reflect upon the industry as a whole and to its detriment.

We urge co-operation among our employees, the company and the public; yet are we not prone to exhibit an utter lack of co-operation between our constituent companies which, if properly conducted, would benefit the industry throughout the whole Southwest? It is obvious that in order to encourage co-operation and to obtain the greatest good to the greatest number, an "organization" is necessary, and for that organization to be efficient each member and each company must do its part.

Is it not more beneficial to have a central office to collect and distribute accurate and reliable data, than for each company to collect the data desired and very carefully file away information that, when boiled down and generalized, may be of use to the entire profession of electrical or gas men?

We are only too glad to call for help when we get in a "tight" hole, and have exhausted every visible resource in our effort to combat some erroneous conclusion, which, if allowed to be passed upon by an arbitrary or antagonistic city government, would work a hardship upon a company. Yet there are many companies throughout the State, whose managers do not hesitate to take this responsibility, through false economy or failure to appreciate the fact that there is, close at hand, an organization which stands ready to assist in every legitimate effort to collect and spread the truth about our business.

We know also that there are men in the business who *do* take advantage of the work of the Association, but who do not give it the intellectual, financial or moral support that it deserves. Attendance at the annual meeting may seem a financial burden to

some companies, and hence those who for personal benefit alone would attend, or allow attendance, do not do so on account of the expense. The assertion may be made without fear of contradiction that there is not a man in the business who cannot obtain enough information at one of these meetings to pay his company for his trip twice over, *provided* the man is a seeker after information — comes to the Convention with the intention of receiving benefit.

It has been the fortune of the writer to attend conventions similar to ours for the past sixteen years. He has seen meetings so large as to be unwieldy — men anxious to express their opinion but unable to do so on account of a heterogeneous program; valuable papers sidetracked because of the aspirations of some member for office; and it was truly a relief to see at last year's Convention such a reversal of these conditions. It is generally known that large bodies are unwieldy, move slowly and are difficult to handle in order to bring out a general opinion or conclusion; all of which causes are a justification for the birth and growth of a body like ours which fuses into a uniform mass the ideas of individual members and produces a finished article that is a composite thought suitable for use in any locality.

Here we have no steam roller at work dominating the Convention floor, but each member is a unit whose value to himself and fellow members is measured by his freedom of the floor whenever desired and upon any subject. It has been intimated that the Association is dominated by the members connected with the larger companies. This feeling is no doubt due to the condition existing in *all* associations wherein the active interest and the larger part of the work and support is taken by those who realize that to make a success of an association it is necessary to get into harness and pull, and the man who holds a big job is educated along these lines. He is compelled, by force of circumstances, to "pull and do his utmost," with the result that his motives are misjudged and he is accused of using the association for the benefit of his company or himself, when he is really doing it because the "medium and smaller company members" — from diffidence or a false sense of modesty—will not come forward and insist upon taking *their* share of the responsibility, work and expense. *Some* one has to do all this or the association would quickly go to pieces. The "big-company man," from his larger experience, realizes the absolute need of the association to *all* and pulls off his coat and *works* for the benefit of *all*, and his activity is viewed with suspicion—which is wrong! Coming fresh among you, as the writer did, he has been pleased to notice that, although a large amount of the work, responsibility and the expense is shouldered by the "big-company men," their work in this Association was never selfishly for their own companies. In all that he has seen done there has been an ever-present desire to work for the benefit of *all*—big, medium and little. In fact, instead of feeling aggrieved at the "big-company men" for taking "the heavy end of the log," the medium and small companies should feel thankful that they had such men among them, and with that thankfulness, should come a determination to end such a condition by taking hold stronger themselves and lifting some of this work and responsibility from the shoulders that have borne it so long and so willingly.

We face each year the question of finances, co-operation and growth. These questions hinge upon a broader plan of education, therefore each member should make an honest effort to bring into the Association those companies and men who need the help of this body in solving its troubles, and who can help us by giving us the benefit of their experience and advice. We should not discriminate between large and small. What the 50,000 K. W. plant is to a city of 100,000, the 50 K. W. plant is to a city of 1,000. Each should be, and *is*, a very important factor in the upbuilding of its community and the education of its customers and the public at large relative to the proper uses of our products, the proper services we give, and the honest administration of our company's officers. Too often do we find a company misjudged, abused and discriminated against simply because the management is not informed of a similar condition that has existed and already been remedied within the membership of this Association; and had the management secured the benefit of the experiences and results of similar cases elsewhere, he often would bend his efforts along lines that would much more easily obtain for him the same satisfactory results. Furthermore membership in our Association is of much greater value to the small plant man, since, because of its size, it cannot afford to employ experienced engineers to check results, advise changes and obtain economies. The manager, if conscientious, must provide other means of obtaining this information, and he has no easier, accurate and quicker way to obtain it than through our Association. Not only is there available the information within the office, but each member stands ready and willing to lend his assistance to the other members, and in the end the manager is better served than if he were to depend upon any one man or firm or company. He obtains gratis the opinions and experiences of the best men in the business, and in no other way can he do this as quickly and cheaply as through the medium of the Association and its Office. It is difficult to see how any plant of any size can afford to lose sight of this asset. The big plant man has his home organization to draw upon for his data, yet he, too, is dependent upon the small plant man, and here is where co-operation wields its arm of strength.

The larger the company the greater the opportunity and willingness of politicians to use it as a means to an end, and the more difficult it is to obtain a square deal in municipal and legislative matters. What better force can be had, what more emphatic argument can be used, than to have a body of representative men, from all sections, present the case and bring out the truth, not only as referred to the local situation, but throughout the State?

Why not use the Association as a publicity agency to promulgate the truth about our business?

In conclusion, the answer to the amended question in the first half of this paper is an easy one. "What the Southwestern Electrical and Gas Association *may* do for me" depends largely upon what I do for the Association. If I pay my dues willingly and promptly, if I attend its conventions and sessions regularly and take active part in them, either by paper or discussion, if I make myself a committee of one to obtain new members, if I reply to all inquiries from the office promptly and fully, and if, whenever I am in need of anything in my business that may be obtained through the Association, I immediately apply to that office for the information; then I surely will prove to myself and to my fellow members "what the Southwestern Electrical and Gas Association can—and may—do for me."

1877 Instructions for Reading Meters.

[Communicated.]

In a little book, "Common Sense for Gas Users," published in London in 1877, we find these questions and answers referring to the gas meter, in addition to other matters on which gas consumers of to-day are just as hazy as those of 40 years ago.

"The Meter."

1. For what purpose is the meter used? For measuring and registering the quantity of gas supplied to the consumer, whether it be burnt, or lost by leakage.

2. How does it do this? By recording on the index the number of cubic feet which pass through it.

3. Is there any difficulty in reading and understanding this index? Not to anyone that can tell the time by a watch.

4. Explain the index. In the figure, neglecting the small circle above, we see 3 dials marked respectively 100,000, 10,000, 1,000, which denote the number of cubic feet recorded by one complete revolution of the hand. The hands move in the same direction as the figures count; on the first from left to right, like the hands of a watch; on the second, from right to left: on the third, from left to right. Before any gas has been used, all the hands point to O. On commencing to use, the hand of the right dial will move first. When it arrives at I, it shows that 100 feet of gas has been used; when it points to 5, 500 feet have been used; and so on until it gets to O again, when it indicates that 1,000 cubic feet have passed through the meter. At this stage, the hand on the second dial will have reached I, every figure on this dial indicating a complete revolution of the hand of the dial to its right. Again, when the hand of the middle dial shall have made one complete revolution and arrived at O, it shows that 10,000 feet have passed through the meter, at that stage, the hand on the dial to its left will have reached I, every figure on this dial indicating 10,000.

Now taking the position of the hands in the figure it is evident that it reads 70,000, 6,000, 100, or 76,100 feet of gas as having passed through. By subtracting any former reading from this latter, we get the gas consumed during the interval.

5. Is there any caution required to avoid mistakes? Yes; be sure to take the figure on the dial which the hand has passed, not the figure it is approaching. If there be any question about this, when the hand is very near or just over a figure, it can be decided by referring to the dial to the right, the hand of which will be between O and I if the figure in question has been passed; or between 9 and O if not yet reached.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Anniston (Ala.) Electric and Gas Company has been granted permission to extend its gas mains to Oxford, and this work, when completed, will make a total of nearly $16,000 expended in gas extensions to Anniston suburbs. Improvements at the works, representing $10,000, are practically finished.

THE Goshen (Ind.) Gas Company is making alterations at its plant to better care for its residuals.

THE High Pressure Construction and Supply Company, of Millville, N. J., have installed a 24" ammonia concentrator. The Gas Machinery Company, of Cleveland, O., have completed the erection work and the plant is ready for operation.

GEN. GEORGE H. HARRIES, Vice-President of H. M. Byllesby & Company, President of the Louisville Gas and Electric Company, and officer of several other Byllesby enterprises, recently resigned his post as commanding officer of the District of Columbia National Guard. The organization over which he presided for many years presented him with an equipment of his rank (Major General) in the presence of the command and more than 10,000 spectators. The gift was made in the name of the guard by Brig. Gen. Harvey. It consists of a major general's presentation saber, approximately inscribed, a full dress belt, a full dress sash, a gold belt knot and a pair of silver spurs. In his acceptance, Gen. Harries advocated a universal volunteer army for the United States, including the feature of 30 days military training each year for every able-bodied man between the ages of 18 and 25.

DURING the first four months of this year, the Milan works of the Italian Welsbach Company sent out 2,000,000 incandescent mantles, as against 900,000 in the same four months in 1914. They claim to have captured the whole market of Egypt and British India.

W. H. FRITCHMAN & Co. have been appointed engineers for the Medina (N.Y.) Gas Company and the Fidelity Gas Light Company of Hoosic Falls, N. Y., and will reconstruct these two plants.

THE Southwestern Gas Company is extending its mains to all parts of Brenham, Tex., that ask for gas service. Since its establishment, about four years ago, the gas company has improved its property until every important street in Brenham is traversed by its mains.

THE Worcester (Mass.) Gas Light Company is installing at the new coke handling building at the Quinsigamond plant the most modern machines for measuring and filling coke into bags and baskets. Four machines are to be used in bagging coke, and one will measure and fill a half bushel bag in 20 seconds. The four machines, working 10 hours a day, will fill 7,200 bags. The other four machines will be used for filling baskets which hold two bushels. The coke plant is being constructed by the Riter-Conley Company, and has a capacity of handling 200 tons of coke a day.

YOUNGSTOWN, O., has granted a new franchise to the East Ohio Gas Company, by which rates for natural gas for domestic use will be 30 cents per 1,000 for three years, and then 35 cents per 1,000 cubic feet.

TRANSFER of the Pocatello (Idaho) Gas and Power Company to the North American Light and Power Company has been completed. Mr. W. A. Baehr is vice-president of the latter company, which has plants in Great Falls and Missoula, Mont., and in Greeley, Col.

THE office of the Douglas (O.) Gas Corporation has been moved to the office of the Douglas Traction and Light Company, on 10th street. This places the offices of all the public utilities of Douglas, with the exception of the municipal owned water, under one roof.

WITH the prospect of installing another battery of coke ovens and the immediate erection of a benzol recovery plant, the Chattanooga Gas and Coal Products Company, at Alton Park, Tenn., is likely soon to eclipse expectations.

WILLIAM NEWBIGGING, the English gas expert, had to remind the city of Grand Rapids, Mich., that it owed him $1,400 for professional services in preparing a report on the gas company.

BY order of Federal Judge Martin J. Wade, the Des Moines (Ia.) Gas Company will begin paying approximately $115,000 refund money to about 30,000 Des Moines gas consumers on December 1. The order permits the company to make the refund directly to each consumer entitled to it. instead of forcing the company and consumer into court, although the entire matter will be transacted under the supervision of the federal court. Approximately 35,000 checks will be written and more than 1,500,000 entries made as a result of the complicated nature of the rebating proposition.

THE Administrative Board of Richmond, Va., has instructed Forstall and Robison, gas engineers, to prepare a plan or layout for the installation of low-pressure gas mains to supply that section of the city known as Ginter Park, Highland Park, Barton Heights, North Richmond and the adjacent territory within the city limits. The engineers are requested to avoid paved streets as far as possible, and to adopt for the mains the division lines between lots in the rear where there are no alleys. The board also requests an alternate plan for a low-pressure system, utilizing the present mains of the Henrico County Gas Company.

THE output of the Boston (Mass.) Consolidated Gas Company for the month of August shows a decrease of 3.1% as compared with the corresponding month of last year.

THE new franchise granted the Jamestown (N. D.) Gas Company is to run for 20 years, and specifies a maximum rate of $1.60 gross, $1.45 net, if paid within 10 days. One section says: "If any party shall do, or wilfully cause to be done, any act or acts to injure any part of such gas plant, mains, pipes or structure whatsoever, or anything appertaining to the works of such gas company, erected or used, or kept or designed for the purpose of furnishing and supplying said city and the inhabitants thereof with gas, whereby the same may be obstructed or in any way injured or damaged, the person or persons so offending may, upon conviction thereof, be fined not more than $100, or imprisoned for a period not exceeding 90 days, or may be punished by both such fine and imprisonment."

THE amendment to the new ordinance granting the Utah Light and Traction Company a gas franchise in Ogden City provides for the usual rights and privileges, and 50 years life. The rates specified are; For the first 2,000 cubic feet of gas, $1.25 per 1,000 cubic feet. For the next 5,000 cubic feet, $1.15 per 1,000 cubic feet. All in excess of 7,000 cubic feet, $1.00 per 1,000 cubic feet. Fifty cents per month shall be the minimum monthly charge. It gives the gas company the right to raise the price of gas, if the cost of production increases, and if the city commissioners and the gas company cannot agree upon a price in such event, it provides for a submission to arbitration. One hundred dollars worth of gas is granted to Ogden City each year of the franchise.

THE "Doherty News" says: "The first time that exhaust steam has been successfully used in an ammonia concentrator, so far as is known, was recently at the plant of the Toledo Railways and Light Company. The substitution of exhaust for live steam saves the Toledo company $175 monthly."

H. A. WILLARD, Commercial Manager for the Gardner (Mass.) Gas, Fuel and Light Company, has resigned his position to accept the post of travelling representative of William M. Crane Co. of New York. Mr. Willard will be succeeded in the Gardner company by William H. Heathfield.

IN the controversy in Hastings, Neb., the Hastings Gas Company has offered to sell its plant to the city, on the installment plan, for $157,000, plus 10% for "going value." The plan is to place the management of the plant in the hands of a board of five trustees, two representing the gas company, two the city and the fifth selected by these four. Fixing rates at whatever figure they please,

these trustees shall devote all surplus, after the expenses have been paid, including interest on the investment, to paying for the plant. Ten thousand dollars a year will be expected by the owners. The gas company officials say that they take this course to combat the $1.25 gas talk initiated by the mayor.

M. R. BUMP, chief engineer of the Doherty organizations, and who has been with them for 12 years, has resigned, as of October 1st, to go into the lead business. His successor is F. J. Derge, who has been superintendent of the Toledo Railways and Light Company.

THE small gas holder at the Municipal Light plant, Westfield, Mass., has been enlarged and its capacity increased from 53,000 cubic feet to 133,000 cubic feet. After the new holder has been thoroughly tested, the larger holder will be emptied and much needed repairs made. The sum of $6,500 was appropriated some time age for repairs and improvements on the larger holder.

MASSACHUSETTS Gas, through its subsidiary, the New England Manufacturing Company, has begun shipments of trinitrotoluol from the new plant at North Woburn. It was expocted that shipments of explosives would begin a month ago, but production had to be postponed, owing to unavoidable delays in construction and some changes in the plans of the factory, the latter costing considerably above the original estimates of about $300,000. The present output is between 3,000 and 4,000 pounds daily.

THE Corporation Commission of Oklahoma has issued its report in the matter of the conservation of natural gas and cites its findings of facts, opinion and order in a 57-page publication. Some striking statistics are given and a set of rules and regulations issued that the commission believes will eliminate waste. Waste is defined as (a) escape of natural gas in commercial quantities in open air; (b) the intentional drowning with water of a gas stratum capable of producing in commercial quantities; (c) underground waste; (d) the permitting of any natural gas well to wastefully burn, and (e) the wasteful utilization of such gas. A set of 28 regulations are prescribed and the need of elimination of waste is fully and practically met by the regulations prescribed, without unnecessary hardship upon operators.

WM. M. STEWART and G. L. Hayes, under the firm style of The Stewart & Hayes Electrical Co., will open about October 15th, in Weed Building, Fulton street, Troy, N. Y. They propose to do electric wiring and gas fitting, and to handle a complete line of gas and electric supplies and appliances. Mr. Stewart was, for several years, connected with the E. G. Bernard Co., of Troy; was for 8 years superintendent of the Adams (Mass.) Gas Light Co., later superintendent of distribution for the North Adams, Adams and Williamstown Gas Companies, and for some 4 years past with the Devoe-Stewart Electric Co., which connection he now severs to form the new company. Mr. Hayes resigns his position as commercial manager of the Greenfield Gas Light Co., to associate himself with the new company. Previous to his connection with the Greenfield Company, Mr. Hayes was commercial manager for the North Adams, Adams and Williamstown Gas Companies, and prior to that for 8 years secretary of the Albany Foundry Company, Albany, N. Y.

THE new rate ordered for the Kokomo Gas Company by the Indiana Commission ranges from $1.10 per thousand to 85 cents, with a monthly minimum of 50 cents.

LEGAL action has been instituted between the Stacey Manufacturing Company and the Stacey Brothers Construction Company to determine the right of the latter company to use the name Stacey.

WORK on the gas main being laid by the Birmingham (Ala.) Railway, Light and Power Co., from Third avenue and Thirteenth street, Ensley to Fairfield. has been discontinued by order of the city commission, and the permit revoked, because it was ascertained that the main was to be used for a connection with the mains of the Tennessee Coal, Iron and Railroad Company to supply coke oven gas to the city mains. Commissioner Weatherley stated he objected to the company furnishing by-product gas to the city without its knowledge and consent, and without any attempt to change the existing contract. He recalled the fact that the city had refused to permit the use of by-product gas last year, even at a much reduced rate.

UTILITIES COMMISSION NEWS.

DISASTROUS COMPETITION.—The following is quoted from the decision of the Oregon Public Service Commission in fixing rates for the Hood River Gas and Electric Company, July 14, 1915:

"Immediately there began a bitter competitive war, with the usual incidents to such form of commercial activity—rebates, rate cutting, flat rates entirely disproportionate to the service rendered, free service and even physical interference with the system of the competitor. The population of Hood River City and Valley, and the nature of the local industries, largely centered around the growth and sale of apples, were entirely insufficient to support two utilities so competing for the limited amount of business which the territory could offer. Bankruptcy for both companies was inevitable. The approval of the public utilities act, November, 1912, imposed heavy penalties for a continuance of the rate cutting, rebating and grossly unjust discriminations which had been the usual strategy, and brought about a stalemate. On January 15, 1913, less than a year from the time the Hydro-electric Company commenced commercial service, the interests which controlled the Pacific Power and Light Company and the Hood River Gas and Electric Company bought the outstanding stock of the Hydro-Electric Company. A semblance of competition between the two companies was maintained thereafter until the report of the Commissioner who audited their accounts was produced at the hearing in the present proceedings, when the Commission recommended the prompt consolidation of the two companies in fact in the interest of economy of operation," and obviously in the interest of the public.

CALIFORNIA COMMISSION ON VALUE.—In the application of the People's Water Company for reorganization before the California Railroad Commission, Commissioner Egerton discussed the several methods of arriving at value:

"Various methods have been put forward of determining the value of a public utility plant. They include a determination of the original cost of the plant by inspecting the records of the company; the opinion of engineers as to the original cost based upon the reproduction of the plant as of the time it was constructed under the methods then existing, but applying present-day unit prices; and an opinion as to the cost of reproducing the plant at the present time, less depreciation representing deterioration found now to exist in the plant.

"I hold that these methods are merely guides in the determination of value, and it cannot be said that any one of them may be selected and followed strictly to a result that produces, without modification, a thorough value. For instance, the method most favored is 'reproduction new' less depreciation, but a very brief consideration of this method will make it apparent that in many instances serious modifications of the result obtained must be made to avoid absurd and unjust results.

"I believe the 'reproduction new' method is valuable as a guide in arriving at the value, but I consider it only a guide.

"It has been urged that the true measure of value is the actual investment or original cost. But, in addition to the fact that it is usually impossible to obtain accurate data as to original cost of properties established and operated for a number of years, there is the further difficulty that if the original cost showed extravagant expenditure, or expenditure largely in excess of that which was necessary, aside and apart from the utility itself, it must be modified to a point where it is made reasonable. Furthermore, we have the important element of appreciation in land values to deal with, and it has been held by our courts that a utility is not bound by the original cost of its land. I do not mean to say that original cost is not to be considered and given weight, but that original cost, if it can be obtained, does not of necessity fix the value of the plant.

"It is my opinion that in determining the value of a plant, methods of arriving at depreciation are valuable only as they indicate the present condition and the probable future life of the structures."

UP AGAINST STATE AUTHORITY.—The Holyoke, Mass., municipal gas and electric department has received notification that the Holyoke Street Railway Company has appealed to the State commission for authority to overrule the decision of the board of aldermen. The Street Railway Company petitioned to be allowed to transmit electricity over its wires to Mountain Park, the current to be furnished by an out of town power company. The board of aldermen turned down the petition, and the street railway company appealed to the State board.

Financial Notes.

CITIES SERVICE COMPANY reports for July 31st:

	12 months ending July 31, 1915.	*12 months ending July 31, 1914.	Month of July, 1915.
Gross earnings	$4,003,721.67	$3,543,736.90	$297,626.58
Expenses	153,578.41	97 269.26	14,370.29
Net earnings	3,850,142.26	3,446,467.64	283,255.29
Interest on notes	489,999,99	320,991.07	40,823,33
Net to stock	3,360,143.27	3,125,476.57	242,421.96
Div. pf. stk. and Accd.	**1,593,996.00	1,422,124.60	**130,833.00
Net to common	1,766,147.27	1,703,351.97	111,588.96
Divs. common stock		702,686.01	
Net to surplus	1,766,147,37	1,000,665.96	111,588.96
Surplus reserve	358,198.48		
Surplus	4,163,667.12		
Total surp. & reserve	4,521,865.60		
Ratio "net to stk." to pfd. divs. pd. & accd.	210.80%	219.78%	
% earn. on com. stk.	11.84%	11.73%	

* The twelve month's statement ending July 31, 1914, covers the period three months prior and nine months subsequent to the acquisition by the Cities Service Company of the Utilities Improvement Company and the Consolidated Cities Light, Power and Traction Company.

** Accrued.

Preferred stock outstanding $26,168,426.00
Common stock outstanding 14,718,380.00
Gross earnings of subsidiary properties for twelve months ending June 30, 1915 ..... $20,256,538.87

The statement shows 11.84% earned on the common stock for the year to date, the highest point so far in the history of the company. The earnings for the month of July show an increase in net to stocks of $20,580.44 over the figures for July, 1914.

AMERICAN LIGHT AND TRACTION COMPANY is commencing to show the effects in earnings of the industrial improvement, according to reports just issued. For the six months of 1915, earnings of subsidiary companies, applicable to dividends on stocks of the parent company, increased $300,000 over the first half of 1914. For July, earnings gained $81,100, or 27% over July, 1914. The improvement is fairly well distributed over the subsidiaries, with Detroit City Gas making the largest gains and the Milwaukee Gas Light Company running well above what had been estimated. The common stock is quoted at from 318 to 322 and has risen 10 to 14 points iu the last two months.

THE FALL RIVER GAS WORKS COMPANY has filed with the Massachusetts Secretary of State a statement of its financial condition, dated June 30, 1915, which we compare as follows:

Assets:	1915.	1914.
Land and buildings	$336,955	$334,867
Machinery	1,751,244	1,642,704
Adv. payments	4,340	42,575
Materials and supplies	105,088	93,080
Cash and debts receivable	120,777	141,182
Automobiles	1,506	1,734
Subscription to capital stock	13,400	.....
Moneys rec'd including val. collateral	7,355	6,712
Total	2,340,668	2,262,777
Liabilities:		
Capital stock	1,113,600	805,000
Other debts	19,997	635,998
Reserve for depreciation	113,346	113,346
Accrued taxes	14,989	13,148
Profit and loss	480,629	433,222
Premium on sale of stock	563,948	255,348
Subscriptions	13,400	....
Neg. received for stock	13,400	.....
Guaranty Fund	7,355	6,712
Total	2,340,668	2,262,777

A FLATTERING number of applications have already been made for the first mortgage 5% bonds of the PUBLIC SERVICE BUILDING COMPANY, which will erect the 18-story office building in Baltimore for the Consolidated Gas, Electric Light and Power Company. The authorized issue of bonds is $900,000. They will be dated Aug. 2, 1915, and will be due Aug. 1, 1940. A feature of the bonds, which is unusual, is that they will come before the preferred stock and just after the bonds of the Consolidated, which guarantees by indorsement the principal and interest of the issue. The security is a first mortgage on the real estate acquired by the company at the southeast corner of Lexington and Liberty streets, the ground for which cost in excess of $500,000. The building to be erected will cost not less than $1,100,000. A sinking fund, which will begin in 1920, is figured to pay off about half the issue, so that at maturity the bonds remaining to be paid off will represent less than the cost of the land to-day.

THE UNION GAS AND ELECTRIC COMPANY, a subsidiary of Columbia Gas and Electric, has substituted $600,000 in cash for bonds of the Columbia Gas and Electric Company in the fund deposited to guarantee dividends on the stock of the Cincinnati Gas and Electric Company.

THE STANDARD GAS AND ELECTRIC COMPANY has declared a regular quarterly dividend of 1% payable in scrip on preferred stock September 15.

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